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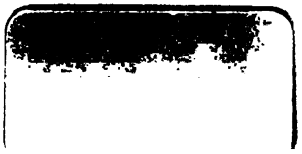

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TRANSACTIONS

OF THE

American Dental Association

AT THE

EIGHTEENTH ANNUAL SESSION,

HELD AT NIAGARA FALLS,

Commencing on the 6th of August, 1878.

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1879.

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CATALOGUED
AUG 7
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LIST OF OFFICERS FROM DATE OF ORGANIZATION.

PRELIMINARY CONVENTION, NIAGARA FALLS, AUGUST, 1859.

President,	W. W. ALLPORT, - -	Chicago.
Secretary,	J. TAFT, - - - -	Cincinnati.

ORGANIZATION AND FIRST SESSION OF ASSOCIATION, WASHINGTON, D. C., JULY, 1860.

[Annual meetings to be hereafter last Tuesday in July.]

President,	W. H. ATKINSON, - -	Cleveland.
1st Vice-President,	J. B. GIBBS, - - -	Washington, D. C.
2d Vice-President,	W. CAHOON, - - -	Detroit, Mich.
Recording Secretary,	J. TAFT, - - - -	Cincinnati.
Corresponding Secretary,	W. MUIR ROGERS, -	Shelbyville, Ky.
Treasurer,	S. DILLINGHAM, - -	Philadelphia.

[NO MEETING IN 1861.]

CLEVELAND, JULY, 1862.

President,	GEO. WATT, - - -	Xenia, Ohio.
1st Vice-President,	W. H. ALLEN, - - -	New York City.
2d Vice-President,	W. D. STONE, - -	Lexington Ky.
Recording Secretary,	J. TAFT, - - - -	Cincinnati.
Corresponding Secretary,	J. F. JOHNSTON, - -	Indianapolis.
Treasurer,	W. A. PEASE, - - -	Dayton, Ohio.

PHILADELPHIA, JULY, 1863.

President,	W. H. ALLEN, - -	New York City.
1st Vice-President,	J. H. MCQUILLEN, - -	Philadelphia.
2d Vice-President,	WM. B. HURD, - -	Brooklyn, N. Y.
Recording Secretary,	J. TAFT, - - - -	Cincinnati.
Corresponding Secretary,	C. R. BUTLER, - -	Cleveland.
Treasurer,	A. C. HAWES, - - -	New York City.

NIAGARA FALLS, JULY, 1864.

President,	J. H. MCQUILLEN, -	Philadelphia.
1st Vice-President,	C. P. FITCH, - - -	New York City.
2d Vice-President,	H. BENEDICT, - -	Detroit.
Recording Secretary,	J. TAFT, - - - -	Cincinnati.
Corresponding Secretary,	GEO. W. ELLIS, - -	Philadelphia.
Treasurer,	I. J. WETHERBEE, - -	Boston.

CHICAGO, JULY, 1865.

President,	C. W. SPALDING,	St. Louis.
1st Vice-President,	GEO. H. CUSHING,	Chicago.
2d Vice-President,	JAS. MCMANUS,	Hartford.
Recording Secretary,	J. TAFT,	Cincinnati.
Corresponding Secretary,	L. D. SHEPARD,	Boston.
Treasurer,	I. J. WETHERBEE,	Boston.

BOSTON, JULY, 1866.

President,	C. P. FITCH,	New York City.
1st Vice-President,	W. H. MORGAN,	Nashville.
2d Vice-President,	L. D. SHEPARD,	Boston.
Recording Secretary,	J. TAFT,	Cincinnati.
Corresponding Secretary,	A. HILL,	Norwalk, Conn.
Treasurer,	W. W. SHEFFIELD,	New London, Conn.

CINCINNATI, JULY, 1867.

President,	A. LAWRENCE,	Lowell, Mass.
1st Vice-President,	P. G. C. HUNT,	Indianapolis, Ind.
2d Vice-President,	A. S. TALBERT,	Lexington, Ky.
Recording Secretary,	J. TAFT,	Cincinnati.
Corresponding Secretary,	C. R. BUTLER,	Cleveland.
Treasurer,	W. H. GODDARD,	Louisville, Ky.

NIAGARA FALLS, JULY, 1868.

President,	JONATHAN TAFT,	Cincinnati.
1st Vice-President,	HOMER JUDD,	St. Louis.
2d Vice-President,	A. A. BLOUNT,	Springfield, Ohio.
Recording Secretary,	EDGAR PARK,	St. Louis.
Corresponding Secretary,	JAS. MCMANUS,	Hartford.
Treasurer,	W. H. GODDARD,	Louisville.

SARATOGA SPRINGS, AUGUST, 1869.*

President,	HOMER JUDD,	St. Louis.
1st Vice-President,	S. J. COBB,	Nashville.
2d Vice-President,	C. E. FRANCIS,	New York City.
Recording Secretary,	M. S. DEAN,	Chicago.
Corresponding Secretary,	I. A. SALMON,	Boston.
Treasurer,	W. H. GODDARD,	Louisville.

* Owing to a change in the Constitution, officers elected at this and the sessions following served at the next annual meeting subsequent to their election; and the sessions on and after 1869 commenced on the first Tuesday in August.

NASHVILLE, AUGUST, 1870.

President,	W. H. MORGAN,	Nashville.
1st Vice-President,	S. W. DENNIS,	San Francisco.
2d Vice-President,	J. R. WALKER,	New Orleans.
Recording Secretary,	M. S. DEAN,	Chicago.
Corresponding Secretary,	I. A. SALMON,	Boston.
Treasurer,	W. H. GODDARD,	Louisville.

WHITE SULPHUR SPRINGS, VA., AUGUST, 1871.

President,	GEO. H. CUSHING,	Chicago.
1st Vice-President,	C. E. FRANCIS,	New York City.
2d Vice-President,	J. R. WALKER,	New Orleans.
Recording Secretary,	M. S. DEAN,	Chicago.
Corresponding Secretary,	I. A. SALMON,	Boston.
Treasurer,	W. H. GODDARD,	Louisville.

NIAGARA FALLS, AUGUST, 1872.

President,	P. G. C. HUNT,	Indianapolis.
1st Vice-President,	L. D. SHEPARD,	Boston.
2d Vice-President,	G. A. MILLS,	Brooklyn, N. Y.
Recording Secretary,	M. S. DEAN,	Chicago.
Corresponding Secretary,	J. TAFT,	Cincinnati.
Treasurer,	W. H. GODDARD,	Louisville.

PUT-IN-BAY, AUGUST, 1873.

President,	T. L. BUCKINGHAM,	Philadelphia.
1st Vice-President,	ISAIAH FORBES,	St. Louis.
2d Vice-President,	A. F. MCLAIN,	New Orleans.
Recording Secretary,	M. S. DEAN,	Chicago.
Corresponding Secretary,	J. TAFT,	Cincinnati.
Treasurer,	W. H. GODDARD,	Louisville.

DETROIT, AUGUST, 1874.

President,	M. S. DEAN,	Chicago.
1st Vice-President,	GEO. W. KEELY,	Oxford, Ohio.
2d Vice-President,	J. S. KNAPP,	New Orleans.
Recording Secretary,	C. STODDARD SMITH,	Springfield, Ill.
Corresponding Secretary,	GEO. L. FIELD,	Detroit.
Treasurer,	W. H. GODDARD,	Louisville.

NIAGARA FALLS, AUGUST, 1875.

President,	A. L. NORTHROP, - -	New York City.
1st Vice-President,	H. J. MCKELLOPS, - -	St. Louis.
2d Vice-President,	H. A. SMITH, - -	Cincinnati.
Recording Secretary,	C. STODDARD SMITH, -	Springfield, Ill.
Corresponding Secretary,	J. H. MCQUILLEN, -	Philadelphia.
Treasurer,	W. H. GODDARD, - -	Louisville.

PHILADELPHIA, AUGUST, 1876.

President,	GEO. W. KEELY, - -	Oxford, Ohio.
1st Vice-President,	C. N. PEIRCE, - - -	Philadelphia.
2d Vice-President,	CORYDON PALMER, -	New York City.
Recording Secretary,	C. STODDARD SMITH, -	Springfield, Ill.
Corresponding Secretary,	J. H. MCQUILLEN, -	Philadelphia.
Treasurer,	W. H. GODDARD, - -	Louisville.

CHICAGO, AUGUST, 1877.

President,	F. H. REHWINKEL, -	Chillicothe, Ohio.
1st Vice-President,	L. D. SHEPARD, - -	Boston.
2d Vice-President,	GEO. T. BARKER, - -	Philadelphia.
Recording Secretary,	M. S. DEAN, - - -	Chicago.
Corresponding Secretary,	M. H. WEBB, - -	Lancaster, Pa.
Treasurer,	W. H. GODDARD, - -	Louisville.

NIAGARA FALLS, AUGUST, 1878.

President,	H. J. MCKELLOPS, - -	St. Louis.
1st Vice-President,	L. D. SHEPARD, - -	Boston.
2d Vice-President,	L. D. CARPENTER, -	Atlanta, Ga.
Recording Secretary,	GEO. H. CUSHING, - -	Chicago.
Corresponding Secretary,	A. O. RAWLS, - -	Lexington, Ky.
Treasurer,	W. H. GODDARD, - -	Louisville.

EXECUTIVE COMMITTEE, 1878–9.

J. N. CROUSE, Chairman, THOS. FILLEBROWN, Secretary.

FIRST DIVISION — COMMITTEE OF ARRANGEMENTS.

FILLEBROWN, CUSHING, AND JUDD.

SECOND DIVISION — ON CREDENTIALS AND AUDITING COMMITTEE.

CROUSE, KEELY AND NORTHROP.

THIRD DIVISION — ON NOMINATIONS AND VOLUNTEER ESSAYS.

MORGAN, BLACK AND PEIRCE.

CONTENTS.

MINUTES OF SECRETARY.

Roll-call, - - - - - - - - - - - - - - - 9
Reading and amending of minutes of last session, - - - - - 12
Vacancies filled in Executive Committee, - - - - - - - 12
Report on Credentials, - - - - - - - - - - - 12
Report of Corresponding Secretary, - - - - - - - - - 13
Report of Committee on "Sections," - - - - - - - - 14
Report of Minority on "Sections," - - - - - - - - - 19
Report of Committee on Volunteer Essays, - - - - - - 21
Report of Publication Committee, - - - - - - - - - 23
Report of Treasurer, - - - - - - - - - - - - - 23
Report of Committee on Prize Essays, - - - - - - - - 29
Report of Special Committee on amendment of Constitution, - - 29
Resignation of J. J. Birge, - - - - - - - - - - - 13
Amendments to Constitution acted on, - - - - - - - - 14, 18
Invitation to physicians and dentists, - - - - - - - - 18
Committee appointed on amendment to Constitution, - - - 18
Vacancies in Committee on Prize Essays filled, - - - - - 19
Motion for extra session, - - - - - - - - - - - 22
Motion to pay bills for printing and of Publication Committee, - - 22
Motion to reconsider vote on special order on Sections, - - - 22
Motion to adopt amendments, "Sections," - - - - - - - 22
Motion of Dr. Fillebrown on Medical Schools, - - - - - 24
Motions of Drs. Wetherbee, Shepard, Rehwinkel, Buckingham and Crouse, on certificate of Membership, - - - - - - - 25
Motion of Dr. Shepard on delinquents, - - - - - - - 25
Motion of Dr. Spalding on revision of Constitution, - - - - 26
Motion of Dr. Taft on death of Dr. Barker, - - - - - - 26
Motion of Dr. Shepard as to printing Constitution, - - - - 26
Motion of Dr. Taft, respecting telegram from Dr. Dennis, - - 26
Motion of Dr. Shepard, regarding report of Chairman of Committee on Committee on Operative Dentistry, - - - - - - - 27
Motion of Dr. Crouse for extra session, - - - - - - - 27
Motion of Dr. Crouse to take the subject of certificate of membership from table, - - - - - - - - - - - - - - 28
Motion of Dr. Taft to install officers, - - - - - - - - 28
Motion of Dr. Shepard to reconsider Dr. Spalding's motion and to amend, - - - - - - - - - - - - - - 30
Motion of Dr. Taft, votes of thanks, - - - - - - - - 30
Selection of place of next meeting, - - - - - - - - - 26
Election of officers, - - - - - - - - - - - - - 27
Organization of Sections, - - - - - - - - - - - 28
Memorial page, - - - - - - - - - - - - - - 31
Amended Constitution, - - - - - - - - - - - - 33

Reports and Volunteer Papers.

Report on Dental Nomenclature and Terminology—W. H. Atkinson, 45
Report on Physiology — M. S. Dean, 50
Report on Physiology — J. H. McQuillen, 60
Report on Histology and Microscopy — G. V. Black, 65
Report on Histology and Microscopy — C. N. Peirce, 78
Report on Histology and Microscopy — G. F. Waters, 115
Report on Pathology — W. H. Atkinson, 131
Report on Dental Education — J. N. Crouse, 141
Report on Dental Education — Thos. Fillebrown, 148
Report on Dental Education — Geo. J. Friedrichs, 155
Report on Therapeutics — F. M. Odell, 173
Report on Dental Literature — C. D. Cook, 185
Report on Operative Dentistry — M. H. Webb, 198
Report on Dental Chemistry — L. G. Noel, 219
Volunteer paper, Histology and Microscopy — C. F. W. Bödecker, 91
Volunteer paper, Operative Dentistry — Geo. J. Friedrichs, 210
Volunteer paper, Operative Dentistry, D. D. Smith, 213

Discussions.

Nomenclature and Terminology — discussed by
Dr. John Allen, 49
Physiology — discussed by
Dr. Atkinson, 58
Histology and Microscopy — discussed by
Dr. Spalding, 121
Dr. Buckingham, 122
Dr. Atkinson, 124, 128
Dr. McQuillen, 125, 130
Dr. Black, 126
Dr. Dean, 127
Dental Education — discussed by
Dr. R. Finley Hunt, 159
Dr. Ingersoll, 160, 171
Dr. Fillebrown, 160
Dr. Jas. Taylor, 162
Dr. Flagg, 163
Dr. John Allen, 163, 172
Dr. Wetherbee, 164
Dr. Darby, 165
Dr. Atkinson, 166
Dr. Spalding, 167
Dr. McQuillen, 169
Dr. Crouse, 172
Therapeutics — discussed by
Dr. Spalding, 181
Dr. Flagg, 182
Dr. Atkinson, 182
Dental Literature — discussed by
Dr. McQuillen, 195
Dr. Atkinson, 196
Dental Chemistry — discussed by
Dr. Atkinson, 222

MINUTES OF TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION

SESSION OF 1878.

By M. S. DEAN, Secretary.

FIRST DAY—MORNING SESSION.

THE AMERICAN DENTAL ASSOCIATION commenced its Eighteenth Annual Session at Grant Hall, Niagara, Tuesday, August 6, 1878, at 10 A.M.; the President, F. H. REHWINKEL, in the chair.

The exercises were opened with prayer by DR. MORGAN.

The roll of qualified members was then called, and the following members answered to their names:*

ALLEN, W. H.	18 West Eleventh st., New York.
ALLEN, JOHN	314 Fifth ave., New York.
ATKINSON, W. H.	41 East Ninth st., New York.
ABBOTT, FRANK	12 West Nineteenth st., New York.
AMBLER, J. G.	25 West Twenty-third st., New York.
* BIDDLE, C. H.	50 Livingston st., Brooklyn, N. Y.
BUCKINGHAM, T. L.	1206 Vine st., Philadelphia.
BLACK, G. V.	Jacksonville, Ill.
BECK, C. S.	Wilkesbarre, Penn.
BEACH, H. E.	Clarksville, Tenn.
BROWN, SEN. B.	Fort Wayne, Ind.
BARRETT, W. C.	Warren, N. Y.
* BRONSON, W. A.	8 East Thirty-fourth st., New York.
BROPHY, T. W.	126 State st., Chicago.
BRACKETT, C. A.	Newport, R. I.

* Those marked with a star were not present, but forwarded their dues.

* Colton, A.	Hudson, N. Y.
* Chaim, M. L.	30 Cooper's Institute, New York.
Crouse, J. N.	734 Michigan ave., Chicago.
Cushing, Geo. H.	174 State st., Chicago.
Cummings, S. M.	Elkhart, Ind.
Cassidy, J. S.	Covington, Ky.
Cleland, Jas.	Detroit, Mich.
Carpenter, L. D.	Atlanta, Ga.
Cook, C. D.	133 Pacific st., Brooklyn, N. Y.
Clancy, D. W.	Cincinnati, Ohio.
Carman, G. W.	Englewood, N. J.
Dennis, S. W.	33 Kearney st., San Francisco, Cal.
Dean, M. S.	174 State st., Chicago.
Darby, E. T.	1513 Walnut st., Philadelphia.
Douglass, I.	Romeo, Mich.
Eames, W. H.	1224 Washington ave., St. Louis.
Emminger, A. F.	Columbus, Ohio.
Freeman, S. A.	Buffalo, N. Y.
Fillebrown, Thos.	Portland, Maine.
Field, Geo. L.	Detroit, Mich.
Fuller, A. H.	1225 Washington ave., St. Louis.
Flagg, J. F.	Philadelphia.
Friedrichs, Geo. J.	155 St. Charles st., New Orleans.
Farrar, J. N.	94 Green ave., Brooklyn, N. Y.
Forbes, Isaiah	Eighth st., St. Louis.
Goddard, Wm. H.	Louisville, Ky.
Gorgas, F. J. S.	Baltimore, Md.
* Gaylord, E. S.	New Haven, Conn.
How, W. S.	Cincinnati, Ohio.
Hooper, J.	Owenton, Ky.
Harlan, A. W.	70 Dearborn st., Chicago.
Hunt, R. Finley	1806 H st., Washington, D. C.
Hall, J. W.	1337 Washington ave., St. Louis.
Hill, J. L.	Gettysburg, Pa.
Harper, J. G.	1605 Washington ave., St. Louis.
Hoag, Wm. E.	135 Lexington ave., New York.
* Hunter, E.	Jackson, Mich.
* Holmes, E. S.	Grand Rapids, Mich.
* Hurtt, J. M.	Peoria, Ill.
Ingersoll, L. C.	Keokuk, Iowa.
Jarvie, Wm., Jr.	Brooklyn, N. Y.
Jackson, H. H.	319 Jeff. ave., Detroit, Mich.
Keely, Geo. W.	Oxford, Ohio.
Klump, G. W.	Williamsport, Penn.
King, Coulter	Pittsburgh, Pa.
* Kingsbury, A. C.	Philadelphia.

LATHROP, J.	152 Woodward ave., Detroit, Mich.
*MCMILLAN, J. T.	Paris, Ky.
MORGAN, W. H.	Nashville, Tenn.
MCMANUS, JAS.	Hartford, Conn.
MCKELLOPS, H. J.	615 Olive st., St. Louis.
MCQUILLEN, J. H.	1713 Arch st., Philadelphia.
MCDONALD, G. B.	Conneautville, Penn.
*MARRINER, J. F.	Ottawa, Ill.
*NOYES, EDMUND	103 State st., Chicago.
*NOBLE, H. B.	1111 Penn. ave., Washington, D. C.
*OSMOND, E.	266 Vine st., Cincinnati, Ohio.
ODELL, F. M.	18 West Eleventh st., New York.
PEIRCE, C. N.	1617 Green st., Philadelphia.
PRIEST, A. N.	Utica, N. Y.
PALMER, S. B.	Syracuse, N. Y.
PALMER, EDGAR	La Crosse, Wis.
PAGE, W. E.	142 Main st., Charlestown, Mass.
RICHARDS, F. J.	Williamsport, Pa.
RIGGS, W. E.	Lawrence, Mass.
REHWINKEL, F. H.	Chillicothe, Ohio.
RAWLS, A. O.	Lexington, Ky.
RHONE, J. W.	Bellefonte, Penn.
REYNOLDS, W. M.	62 West Fourteenth st., New York.
*SAGE, H. L.	Bridgeport, Conn.
SHEPARD, L. D.	100 Boylston st., Boston.
*SWARTLEY, J. S.	749 Michigan ave., Chicago.
SPALDING, C. W.	1606 Olive st., St. Louis.
SMITH, A. WILKES	Richmond, Ky.
SMITH, H. A.	286 Race st., Cincinnati, Ohio.
SMITH, D. D.	1417 Walnut st., Philadelphia.
STOCKTON, C. S.	Newark, N. J.
STIPP, J. A.	Sidney, Ohio.
TAFT, J.	117 West Fourth st., Cincinnati, Ohio.
TEMPLETON, J. G.	299 Penn. ave., Pittsburgh, Pa.
TAYLOR, JAS.	Elm st., Cincinnati, Ohio.
TAFT, WILL	194 West Fourth st., Cincinnati, Ohio.
WATERS, GEO. F.	8 Beacon st., Boston.
WEBB, M. H.	Lancaster, Pa.
WETHERBEE, I. J.	46 Dover st., Boston.
WELCH, CHAS	Wilmington, Ohio.
WATLING, J. A.	Ypsilanti, Mich.
WERNER, J. G. W.	548 Tremont st., Boston.
*WHEELER, C. F.	Albany, N. Y.
WELLS, MERRITT	Indianapolis, Ind.
WHITAKER, GEO. W. H.	Sandersville, Ga.
WAY, S. J.	Waynesville, Warren county, Ohio.
WHINERY, J. C.	Salem, Ohio.

The reading of the minutes of the last annual session was commenced, when the motion that the further reading be omitted, with the exception of those of the final session, was carried.

The minutes were amended so as to include the report of Dr. Hawxhurst, in the sentence on page 27, which says, "the latter was adopted and indorsed."

On motion of Dr. McQuillen, the minutes were further corrected by inserting the following resolution, which had been omitted:

Resolved, That the Corresponding Secretary be instructed to have a certificate of membership of the American Dental Association engraved for the honorary members, and other members who may desire to have it.

And, on motion, the preparation of the design and carrying into effect this resolution were intrusted to Drs. Webb and McQuillen.

On motion of Dr. Shepard they were further amended to show more definitely that the report read by him at the last annual session, on Dental Literature, was written by Dr. W. A. Bronson, a member of that committee.

The minutes of the final session of last year, as amended, were then approved.

Dr. Fillebrown presented a programme of the order of business for the present session, which was accepted and adopted.

The Executive Committee reported the appointment of Dr. G. V. Black to fill the vacancy caused by the absence of Dr. Northrop in the Committee on Appliances, and Dr. C. N. Pierce on the Committee on Nominations, vacated by Dr. Judd.

The Committee on Credentials made a partial report, which, by subsequent reports, was completed, as follows:

Brooklyn Dental Society — W. H. Atkinson, J. N. Farrar.
Chicago Dental Society — A. W. Harlan, G. H. Cushing, T. W. Brophy.
Connecticut Valley Dental Society — J. McManus.
First District Dental Society of the State of New York — W. E. Hoag, Wm. M. Reynolds.
Georgia State Dental Society — L. D. Carpenter, G. W. H. Whitaker.
Illinois State Dental Society — G. V. Black, M. S. Dean, J. N. Crouse.
Indiana State Dental Association — S. B. Brown.
Iowa State Dental Association — L. C. Ingersoll.

Kentucky Dental Association—W. H. Goddard, J. Hooper, A. W. Smith, A. O. Rawls, J. S. Cassidy.
Lake Erie Dental Association—G. B. McDonald.
Maine Dental Society—T. Fillebrown.
Massachusetts Dental Society—J. G. W. Werner, W. E. Page.
Merrimack Valley Dental Society—W. E. Riggs.
Michigan Dental Society—J. Douglass, James Cleland.
Mississippi Valley Association of Dental Surgeons—W. S. How, S. M. Cummings, Chas. Welch, J. A. Stipp, A. F. Emminger, S. J. Way.
Missouri State Dental Association—A. H. Fuller, J. W. Hall.
New York Odontological Society—Wm. Jarvie, jr.
New Jersey State Dental Society—G. W. Carman.
Ohio Dental College Association—James Taylor.
Ohio State Dental Society—J. W. Lydie.
Pennsylvania Association of Dental Surgeons—C. N. Peirce.
Pennsylvania State Dental Society—E. T. Darby.
Pittsburgh Dental Society—J. G. Templeton, C. King.
Tennessee Dental Association—H. E. Beach.
The Dental Society of the State of New York—A. N. Priest.
St. Louis Dental Society—J. G. Harper.
Susquehanna Dental Association—J. W. Rhone.
Boston Dental College—I. J. Wetherbee.
Dental College of the University of Michigan—J. A. Watling.
Dental School of Harvard University—L. D. Shepard.
Missouri Dental College—W. H. Eames.
Pennsylvania College of Dental Surgery—T. L. Buckingham.
Philadelphia Dental College—D. D. Smith.
Western College of Dental Surgeons—C. W. Spalding.

Respectfully submitted. L. D. SHEPARD, J. N. CROUSE, M. H. WEBB, } *Committee on Credentials.*

A letter was read from Dr. J. J. Birge, tendering his resignation to the A. D. A., which was accepted.

The Corresponding Secretary made the following report, which was accepted and laid on the table for further consideration:

Your Corresponding Secretary would respectfully report that he has attended to the duties assigned him, notified the gentlemen who were elected Honorary Members of the Association, viz: John Tomes, M.R.C.S.; Chas. S. Tomes, M.A., M.R.C.S.; J. Smith Turner, M.R.C.S.; George Von Langsdorff, D.D.S.; E. Magitot, M.D.; Adolf Petermann, D.D.S.; Mordaunt Stevens, M.D., D.D.S., M.R.C.S., and Dr. Fr. Wedl. A reply has been received from each of the gentlemen named excepting John Tomes.

In compliance with the resolution passed at the last meeting of this

Association, your Corresponding Secretary, in connection with Dr. McQuillen, has seen to the getting up of a certificate of membership, a copy of which is here presented. MARSHALL H. WEBB,
Corresponding Secretary.

Upon motion of Dr. Cushing, the amendments to the constitution were now taken up.

The amendment offered by Dr. Taft was then read, as follows: Change Art. III, Sec. 4, so as to read—"All delegates shall be practitioners of dentistry; they shall receive their appointment from permanently organized *state* dental societies and dental colleges."

Dr. Dean moved its adoption.

Dr. Crouse moved, as a substitute, that the question be indefinitely postponed. Carried.

The amendment offered by Dr. Keely to change Art. III, Sec. 1, so as to read: "Each local society may send one delegate for every fifteen of its active members," was then read.

Dr. Taft moved to amend by limiting the number to ten members.

The substitute and the motion to adopt the amendment were lost.

On motion of Dr. Cushing, the reports of special committees were called for. Whereupon Dr. Hunt, chairman of the committee of ten on the formation of sections, made the following report:

REPORT OF COMMITTEE ON SECTIONS.

To the American Dental Association:

The action of the American Dental Association in adopting the following resolution has been interpreted by the enlarged committee as a desire that the subject should be more maturely considered and the results of that consideration laid before the Association in a more exhaustive report and a more detailed and perfected plan:

"*Resolved*, That the committee be increased to ten members, and that the report presented by the committee of three be recommitted to said comtee for amendment or reconsideration, and that they be instructed to print the results of their deliberations, and that a copy be mailed to each member of the Association at least one month before the next annual meeting."

Acting upon this interpretation, the committee will endeavor to set forth the advantages and objections attending the introduction of this very material change in the working machinery of the Association. On both these points it will be necessary to compare the probable working and results of the proposed system of permanent sections with the known and tried ones of the present plan of annual committees. The committee cannot do better in that direction than to quote here the second and third paragraphs of the original report, as follows:

"The principle of division of labor and concentration of effort, so extensively adopted in the successful prosecution of ends in so many business interests, and that have been so happily practicalized in this body, would seem to apply with peculiar force to our investigations and researches, since we have before us a field so wide, and embracing so many branches of science, that no one man can hope to master them all, or even a considerable number of them, and at the same time pursue the practice of his profession.

"It can, therefore, hardly be doubted that the members of this Association can accomplish more for the advancement of the interests of our profession by persistently pursuing scientific inquiries, as connected therewith, in a single direction or on a limited number of subjects, than by the present system of preparing papers or essays year after year, and each year on different subjects."

This general comparison may be carried more into detail by saying that, by the plan of annual committees, members are appointed thereon in many instances without having been consulted, and thus placed in charge of subjects not consonant with their tastes or inclinations, and with which they are frequently not familiar.

The papers prepared by the committees thus constituted, although of great value in themselves as embodying the views and opinions of prominent gentlemen of our profession, necessarily contain much of repetition, and lose much of force and efficiency by reason of the unavoidable want of system in the treatment and presentation of the various subjects, and the equally unavoidable aspect which they bear of being but the expression of individual views and opinions.

It is believed that in the proposed system of permanent sections, if properly organized and operated, will be found a remedy for this and other objections. Each member of the Association will be free to select for himself that channel of study and labor which his acquirements, his present knowledge, his taste and predilections, or his desire for special instruction, may lead him to prefer. Each section, being permanent in its membership and continuous from year to year, can present to the Association the results of its labors so systematized and well digested as to be most effective; and the talent and ability of those members who will naturally gravitate to each section will, if not immediately, yet in a short time, give to its dictum on the subject under its charge that type of authority that is now accorded to the writings of Agassiz on Natural History, Liebig on Chemistry, Huxley, Leidy, and Marsh on Comparative Anatomy and Physiology, Tyndall on Physics, etc.

While each section is pursuing the investigation of its particular subject in a thorough and exhaustive manner in a scientific point of view, its members will in turn receive the benefits of similar labors of each of the other sections, thus making the results of the special researches of each section and individual enure more effectively to the benefit of the whole Association and the profession at large.

The objections to the adoption of the system of permanent sections would seem to lie, first, in the difficulty always attending the introduction and organization of new machinery; and, second, in the doubt that may arise whether the members, after uniting with a section, would work so as to make its labors effective. These objections, however, would derive all their weight and force from a want of disposition on the part of the membership and not from any inherent defect or disadvantage of the system itself. Should it present itself in so favorable an aspect as to lead to its adoption, there would be certainly little difficulty, after its details are determined, in carrying it into practical operation. This would simply require willing, intelligent, and properly directed effort.

The first step would be the formation of the sections, which is accomplished by each member choosing his subject or special field of labor and enrolling his name in the section having charge of it. The next would be the organization of the sections by the election of chairmen, and, if desired other officers of each section.

Upon this chairman, as its quasi-executive officer, would naturally devolve the duty of conducting and supervising the work of the section — a trust which it is necessary in all large or small organizations to repose in some one — and this duty and trust always carries with it a greater or less amount of labor. The method of investigation and preparation of the work of the sections for report to the Association must, from the diversity of subjects and manner of handling them, be left to a great extent to the judgment of each section, although there should be a general similarity of plan for all.

It is here suggested that the chairman of each section divide his subject into as many parts or heads as a proper analysis or dissection will permit, and by correspondence or otherwise obtain the conclusions of each member of his section upon all or any one or more of these parts and embody these conclusions with his own in the report prepared by him for the Association. Of course these conclusions should be based on careful investigation and supported by facts, because no proposition or statement has any value in a scientific point of view unless so based and supported; and one great object in the introduction and adoption of this system is to bring the diverse views, theories, and propositions which are at this time or may in future come before our profession, to that test, and thus establish and fortify the true and eliminate those having no solid foundation.

It would probably be well for this Association to constitute the chairmen of the several sections a committee to mature and adopt some general plan, and, as far as they can, the details of the work of the sections.

While it would be desirable that all the members of the Association should have the benefit of the discussions elicited in the sections while making up the reports, yet that is impossible. As now, the consideration of the report made would afford the best occasion for profitable discussion and instruction.

It will be readily understood that while the treatment of the past history and former developments of a subject may make the first two or three reports of a section lengthy, yet, when they shall have been disposed of, the current condition of such subject will probably furnish matter for only brief reports, and at that time, therefore, the number of divisions and sections reported in the following resolutions will not be too great, though at present it may seem cumbersome:

Resolved, That the membership of this Association be, and is hereby, divided into twelve permanent sections, each section to be composed of such members as may elect to unite and form that section.

Resolved, That it shall be the duty of each member of this Association to connect himself with some one of these sections, but that he shall be free to follow his own preferences as to the particular channel in which he will labor, and may, if he so desires, be a member of two or more sections.

Resolved, That the members of each section shall, at each annual meeting of the Association, immediately after the regular election of officers, elect in turn and in the order named, a chairman and such other officers as they may see fit, the names of the members of each section being read and the same tellers canvassing the ballot. And it shall be the duty of the chairman so elected to see that the labors of his section are conducted in the manner calculated to secure the best results.

Resolved, That each section shall have charge of one of the following divisions of the subjects or branches essential to scientific dentistry, and through its chairman, or such other member as it may select, report upon the same to the Association at each annual meeting, in the order in which they are named:

1. Operative Dentistry or Dental Surgery.
2. Artificial Dentistry.
3. Anatomy and Physiology.
4. Histology and Microscopy.
5. Etiology.
6. Pathology and Therapeutics.
7. Chemistry and Materia Medica.
8. Metallurgy and Chemistry of the Metals.
9. Dental Education.
10. Dental Literature.
11. Dental Nomenclature.
12. Dental Appliances.

Resolved, That after the several sections shall have been fully organized and in working condition, it shall be the duty of each chairman to furnish the latest and best information in the possession of his section upon any

point connected with its subject, to any member of another section who, through the chairman of his own section, may apply to him for such information. Respectfully submitted.

R. FINLEY HUNT,
W. H. ATKINSON,
H. A. SMITH,
C. W. SPALDING,
HOMER JUDD,
W. H. MORGAN,
J. H. MCQUILLEN,
} *Committee.*

The Chairman has failed to receive from Drs. Shepard and Crouse authority to affix their signatures, either favorably or adversely, to the report.

On motion of Dr. Shepard, the report was accepted. It was then moved by Dr. Shepard that the report be laid on the table until after the minority report should be read. Carried.

The report of the Special Committee on Nomenclature and Terminology was then read by Dr. Atkinson, and discussed by himself, Drs. Allen and Taft.

On motion of Dr. Fillebrown, all physicians and dentists not members of the Association were invited to seats in this body.

The resolution offered in the report of the Committee on Nomenclature, etc., by vote, was laid on the table until the report of the Committee on Sections should be taken from the table.

On motion of Dr. McQuillen, the amendment offered at the last annual session, p. 24, in regard to representatives from dental colleges was taken up, and, on motion to adopt this amendment, it was discussed by Drs. Hunt, Rawls, and H. A. Smith. Dr. Rawls moved that the question be postponed until the subject of dental education is brought up. Lost.

Discussion then followed by Drs. Atkinson, Wetherbee, Spalding, McQuillen, Flagg, Pierce, Buckingham, Hunt, Morgan, Abbott, McDonald and Rawls.

Dr. Cushing moved that the subject be referred to a special committee of three. Carried. And Drs. Morgan, Fillebrown and Black were appointed by the Chair.

Adjourned to 7 : 30 P.M.

FIRST DAY—EVENING SESSION.

Association convened at 8 o'clock; President Rehwinkel in the chair. Minutes of previous session read, corrected and approved.

On motion, the regular business was suspended for the transaction of miscellaneous business.

Dr. Stockton reported vacancies in the Committee on Prize Essays, by the absence of Drs. Allport and Judd, which were filled by the appointment, by the Chair, of Drs. Morgan and Pierce.

Dr. Shepard stated his readiness to offer a minority report of the Committee on Sections.

Dr. Spalding moved the report be accepted without reading. Lost.

The minority report was then read, and, on motion of Dr. Shepard, was laid on the table for the present.

MINORITY REPORT OF COMMITTEE ON SECTIONS.

The undersigned, members of the Committee on Sections, did not sign the report with the majority, for various reasons.

They were and are in doubt as to the wisdom of dividing the Association into sections, but as the opinion of the members in favor seems to predominate, they would recommend that the experiment be tried. They would also recommend that at first the sections should be few in number, and then subdivided as may seem desirable. As a resolution is of no effect in opposition to the constitution, they beg now to present, without further argument, a minority report in the following draft of amendments to the constitution:

ARTICLE III.

SEC. 3. Insert the words "and membership of the sections" between the words "to office," at the end of the sixth line, and before the words "none being eligible," at the commencement of the seventh line.

ARTICLE V.

SEC. 6. Strike out the sentence "they shall also report to the Association upon any and all appliances which may be placed in their hands," near the bottom of the seventh page of the *printed* constitution.

ARTICLE V.

SEC. 6. Page 8, under head of "third division" strike out the words "names for standing committees for the ensuing year and" between the words "they shall report" and "the names of places."

ARTICLE VI.

Strike out all five sections of Article VI, and insert a new article, as fol lows:

SECTION 1. To prepare, arrange and expedite business, this Association shall be divided into six sections, as follows:

1. Artificial Dentistry, Metallurgy and Chemistry.
2. Dental Education.
3. Dental Literature and Nomenclature.
4. Operative Dentistry.
5. Anatomy, Physiology, Histology, Microscopy and Etiology.
6. Pathology, Therapeutics and Materia Medica.

SEC. 2. It shall be the duty of each permanent member to inform the Recording Secretary, before the close of the morning session of the third day of the annual meeting, which of the six sections he elects to join for the ensuing year. He shall be free to follow his own preferences as to the particular channel in which he will labor, but can be a member of but one section during the same year.

SEC. 3. It shall be the duty of the Recording Secretary, immediately after the close of the above morning session of the third day, to make out lists of the names thus furnished of each section, as a basis for the election of officers of said sections.

SEC. 4. The Association shall, by vote, assign some time after the regular election of officers of the Association for the meeting of the several sections for organization.

SEC. 5. When the time for the organization of the sections has arrived, it shall be the duty of the Recording Secretary to furnish some one member of each section with the list of members of his respective section, which member shall thereupon call the members to order, and read the list of names. The members shall then elect, by ballot, a chairman and such other officers as they may see fit.

SEC. 6. The chairman shall preside at all the meetings of his section; shall exercise general supervision over the business, and shall see that the labors of his section are conducted in the manner calculated to secure the best results. The chairman, or such other member or members as the section shall select, shall prepare and read at the annual meeting of the Association next ensuing, a paper or papers on the advances and discoveries of the past year in the branches included in the section. The reading of such papers shall not together occupy more than forty minutes.

SEC. 7. The several sections shall meet at 10 A.M. on the morning of the first day of the annual meeting of the Association.

SEC. 8. For the information of all members a list of the members of each section shall be published in the Transactions of each year.

ARTICLE VIII.

Under "Order of Business" insert between Nos. 1 and 2 the words "two meetings of the sections at 10 A.M."

Change present No. 2 to 3, and have it read "Organization of the Association at 11 A.M."

Change No. 3 to 4.

Change No. 4 to 5, and strike out the words "Standing Committees," and insert the word "sections."

Change Nos. 6, 7 and 8 to 7, 8 and 9.

Strike out all of No. 9.

Respectfully submitted. L. D. SHEPARD.
J. N. CROUSE.

A report was then read by Dr. Dean, chairman of the Committee on Dental Physiology, which was discussed by Dr. Atkinson.

A report was then read by Prof. McQuillen, a member of the same committee, followed by some verbal remarks by himself.

Adjourned.

SECOND DAY—MORNING SESSION.

Association convened at 10:30 A.M.; President Rehwinkel in the chair.

The minutes of the previous session were read, corrected and approved.

On motion, the rules of order were suspended, and the reports of the Committee on Histology and Microscopy were given precedence in the order of business.

Dr. Black, the chairman of that committee, read a report, upon which Dr. Crouse moved that all the reports and papers upon this subject be read before any discussion takes place. Lost.

The report was then discussed by Dr. Spalding.

Dr. Fillebrown moved that the next paper be now read. Whereupon Dr. Waters, a member of the committee, made a brief verbal report.

This was followed by a report of Dr. Pierce, a member of the same Committee on Histology, etc.

The chairman of the Committee on Volunteer Essays reported favorably on an essay presented by Dr. Atkinson and written by Dr. Bödecker. After a brief discussion as to the propriety of re-

ceiving papers from persons not members of this Association — as was the writer of this — the paper was received by a unanimous vote and read by Dr. Atkinson.

Dr. Buckingham made some remarks upon the report of Dr. Black, and was followed by Dr. Atkinson.

Upon motion of Dr. Crouse, amended by Dr. Spalding, it was voted to have an extra session Thursday afternoon, from 4 to 6 o'clock, to consider miscellaneous business: 1. The reports on sections. 2. The certificate of membership, and other miscellaneous business.

Adjourned.

SECOND DAY—EVENING SESSION.

Association convened at 8 o'clock; the President in the chair. Minutes of previous session read and approved.

Dr. Shepard moved that the bills for printing reports of the Committee on Sections, and programme of the order of business, be paid. Carried.

The following resolution, offered by Dr. Shepard, was adopted:

Resolved, That the Treasurer pay all drafts upon him properly authenticated, for salaries, bills of the Publication Committee, and other expenses of this session.

Dr. Spalding moved that the vote making the consideration of the reports on sections the special order of business for to-morrow from 4 to 6 P.M. be reconsidered. Carried.

Dr. Fillebrown moved that the amendments to the Constitution offered in the minority report of the Committee on Sections be adopted.

On vote, all the amendments were unanimously adopted. See page 19.

The regular order of business was resumed, and the subject of Histology was discussed by Drs. Atkinson, McQuillen, Black and Dean.

On motion, the subject was passed.

The Committee on Pathology and Surgery was called, and Dr. Atkinson, the chairman, read a report, which was discussed by Drs. Spalding and Atkinson.

Adjourned.

THIRD DAY—MORNING SESSION.

Association convened at 10 A.M.; President in the chair. Minutes of previous session read and approved.

Dr. Dean read the following report of the Publication Committee, which was adopted.

Your committee would respectfully report: They have published four hundred copies of the proceedings of the last annual meeting, and transmitted copies of the same to such members of the Association as were entitled to receive them, and also to some public libraries, and to the dental journals in this and in foreign countries.

The proceedings of the past year were somewhat larger than those of any preceding year; and though the work of your committee is not as perfect as they could wish, yet they believe the printed Transactions, with some minor faults, which might be expected from the nature of the material collected, and the rapidity with which the work was accomplished, will compare favorably with those of other similar associations.

The following is a statement of their account with the Association:

AMERICAN DENTAL ASSOCIATION, TO THE PUBLICATION COMMITTEE.

			Dr.
1877.	To publication of 400 copies of Transactions		$395 00
	" Expressage, postage and stationery		35 82
			$430 82
Cr.	By cash from former Secretary	$ 17 00	
	" " " Treasurer	400 00	
	" " Transactions sold	15 48	
			432 48
	Balance due the Association		$1 66

M. S. DEAN, *Chairman Publication Committee.*

TREASURER'S REPORT.

WM. H. GODDARD, TREAS., IN ACCOUNT WITH AM. DENTAL ASSOCIATION.

1877.			*Dr.*
August 7.	To balance	$288 64	
	" cash received for dues during the year	770 00	
			$1,058 64

Contra Cr.

1877.	By paid Publication Committee, balance due for 1876	Order No. 1.	$122 63		
	" " Reporter's fee	" " 2.	150 00		
	" " Secretary's salary	" " 3.	100 00		
	" " Treasurer's salary	" " 4.	100 00		
	" " Chairman Local Com.	" " 5.	15 50		
	" " " Pub. Com.	" " 6.	400 00		
	" " Incidental expenses, postage, stationary, expressage, etc.	Order No. 7.	11 85		
					899 98
1878. August 6.	Balance this day				$158 66

NIAGARA FALLS, August 6, 1878.

We have examined the Treasurer's report, and find it correct.

L. D. SHEPARD,
M. H. WEBB, } *Auditing Committee.*
J. N. CROUSE,

The subjects of Pathology and Surgery were passed.

Reports on Dental Education were read by Drs. Friedrichs, Fillebrown and the chairman, Dr. Crouse.

Dr. Fillebrown then offered the resolution presented in his report. On motion of Dr. J. Taft, the resolution was laid on the table.

Discussion followed on the reports on Education by Drs. Hunt, Fillebrown, Ingersoll, Taylor, Flagg, John Allen, Wetherbee and Darby.

On motion of Dr. Fillebrown, the following resolution, referred to above, was taken from the table:

Resolved, That we deem it expedient and for the best interests of the practice of dentistry, that existing medical schools so enlarge their curriculum as to include sufficient instruction in dentistry, and thus make the requirements for graduation the same for this as for other specialties of medicine.

The resolution was discussed by Drs. Atkinson, Shepard, Spalding, McQuillen and Ingersoll.

Dr. Buckingham moved the previous question, which prevailed. The main question was then put, and the resolution offered by Dr. Fillebrown, in his report on Dental Education, was lost.

The discussion on Dental Education was resumed, and discussed by Drs. Crouse and Cook.

On motion of Dr. Taft, the Association adjourned to 4 o'clock.

THIRD DAY—AFTERNOON SESSION.

Association convened at 4 o'clock; the President in the chair. Owing to the absence of the Secretary, the reading of the minutes was postponed, and Dr. Odell was appointed Secretary *pro tem.*

Dr. Wetherbee moved that the *design* of the certificate of membership be adopted by this Association.

Dr. Shepard moved, as an amendment, that the word "Honorary" be engraved upon the plate between the words "This is to Certify that" and the words "Members of the."

Dr. Rehwinkel offered the following, as a substitute for Dr. Shepard's amendment:

That this certificate be granted to honorary members and to all worthy members of this Association, provided they have retained their membership for five consecutive years, upon the payment of ——, the cost of certificate.

On vote, the substitute was carried.

Dr. Crouse moved that the whole matter be laid on the table. Carried.

Dr. Buckingham moved that an order be drawn on the Treasurer for the payment of the expenses attending the procuring of the certificate; and, also, that the engraved plate be placed in the custody of the Recording Secretary. Adopted.

Dr. Shepard offered the following:

Resolved, That all cases of excusable delinquency for non-payment of dues be referred to the second division of the Executive Committee for consideration and decision, and that said committee is hereby authorized to remit all or a part thereof, at their discretion. Carried.

Upon Dr. Spalding's motion, the following was adopted:

Resolved, That a Committee of *Five*, on Revision and Engrossment of the Constitution, be appointed by the Chair.

In case no new amendments to the constitution are proposed by said committee, they may, at their discretion, cause to be printed 500 copies of the constitution. This committee shall report at the earliest practicable time.

The following were appointed:

Drs. Spalding, Ambler, Fillebrown, Keely and Black.

Dr. Taft moved the appointment of a Committee of Three, to draft suitable preamble and resolutions relative to the death of Prof. Barker.

Drs. Taft, Cushing and Gorgas were appointed by the Chair.

On motion of Dr. Taft, Prof. Buckingham was added to the committee.

Dr. Shepard moved that the constitution, as amended, be published with the Transactions of this session. Carried.

Adjourned.

THIRD DAY—EVENING SESSION.

Association convened at 7:30; President Rehwinkel in the chair.

The minutes of the morning and afternoon sessions were read and approved.

On motion of Dr. Cushing, the order of business was suspended for the transaction of miscellaneous business.

A telegram was read by the President, from Dr. S. W. Dennis, requesting the Association to delay the selection of the next place of meeting, if practicable, until his arrival.

The motion of Prof. Taft to make this the special order of business for 10 o'clock to-morrow morning was lost.

The Association then proceeded to the selection of the next place of meeting and the election of officers.

Niagara was chosen for the next place of meeting.

The election of officers for the ensuing year resulted as follows:

President — H. J. McKellops, St. Louis.
First Vice-President — L. D. Shepard, Boston.
Second Vice-President — L. D. Carpenter, Georgia.
Corresponding Secretary — A. O. Rawls, Kentucky.
Recording Secretary — G. H. Cushing, Illinois.
Treasurer — W. H. Goddard, Kentucky.
Executive Committee — C. N. Pierce, G. V. Black, G. W. Keely.

Adjourned.

FOURTH DAY—MORNING SESSION.

Association convened at the appointed hour; President Rehwinkel in the chair.

Minutes of the preceding meeting read and approved.

A report was read by Dr. Odell, chairman of the Committee on Therapeutics.

Discussed by Drs. Spalding, Flagg and Atkinson.

The subject was then passed.

On the call for the reports on Operative Dentistry being made, Dr. Shepard stated that the report of the chairman of that committee, Dr. H. A. Smith, had been lost; and on motion, it was

Resolved, That in case said report should be found, or reproduced by its author, it be placed in the hands of the Publication Committee.

Dr. Webb read a report on Operative Dentistry, which was followed by volunteer essays, written and read by Drs. Flagg, Friedrichs, Stockton and D. D. Smith.

On motion of Dr. Crouse, an extra session was voted to be held at 3:30 this afternoon.

The subject of Operative Dentistry was passed.

Adjourned to 3:30 P.M.

FOURTH DAY—AFTERNOON SESSION.

Association convened at 3:30 o'clock; the President in the chair.

Minutes of previous session read and approved.

Dr. Crouse moved that the subject of the certificate of membership be taken from the table. Carried.

Dr. Crouse moved that the word "Honorary" be engraved in the blank space on the plate. Carried.

And also that an appropriate seal be engraved for the use of the Association. Carried.

Dr. Taft moved that the newly-elected officers now be installed. Whereupon the President introduced Dr. McKellops in a few happy remarks, which were briefly and appropriately responded to by the incoming President.

On motion, the regular order of business was resumed, and a report prepared by Dr. Noel, a member of the Committee on Chemistry, was read by the Secretary, Dr. Cushing.

Discussed by Dr. Atkinson.

On motion, this subject was passed, and the report on Literature was read by Dr. Cook, chairman.

Discussed by Drs. McQuillen, Cook and Atkinson.

On motion of Dr. Shepard, the regular order was suspended for the purpose of organizing sections. The following organization was effected:

Section 1. Artificial Dentistry, Metallurgy and Chemistry.—R. Finley Hunt, Chairman, C. S. Stockton, Secretary; J. G. Templeton, J. G. Ambler, J. S. Cassidy, A. W. Freeman, J. Hooper, J. Ward Hall, H. H. Keith, D. D. Smith.

Section 2. Education.—J. N. Crouse, Chairman; Thos. Fillebrown, C. W. Spalding, W. S. How, J. G. Werner, L. D. Shepard, John Allen, L. C. Ingersoll, G. H. Cushing, T. W. Brophy, W. H. Morgan, K. B. Davis, Jno. M. Hurtt, C. R. E. Koch, J. L. Hill, J. A. Watling.

Section 3. Dental Literature and Nomenclature.—W. H. Atkinson, Chairman, J. Taft, Secretary.

Section 4. Operative Dentistry.—I. J. Wetherbee, Chairman, W. H. Goddard, Secretary; H. A. Smith, Wm. M. Reynolds, Wm. H. Allen, Geo. J. Friedrichs, Geo. W. Keely, Isaac Douglass, Jas. McManus, Geo. B. McDonald, Isaiah Forbes, G. C. Daboll, E. S. Gaylord, E. Honsinger, F. A. Hunter, H. H. Jackson, C. I. Keely, J. Frank Marriner, W. N. Morrison, Edmund Noyes, E. Osmond, S. B. Palmer, F. M. Shriver, Geo. R. Thomas.

Section 5. Anatomy, Physiology, Histology, Microscopy and Etiology. —M. S. Dean, Chairman, M. H. Webb, Secretary; J. H. McQuillen, C. N. Pierce, G. F. Waters, W. C. Barrett, W. E. Hoag, Merritt Wells, G. V. Black, J. W. Rhone, M. S. Chaim, C. F. Wheeler, D. C. Hawxhurst, H. A. Mansfield, L. G. Noel, C. P. Pruyn.

Divided into three Sub-sections. J. H. McQuillen to report on Anatomy and Physiology; C. N. Pierce to report on Histology and Microscopy; M. H. Webb, to report on Etiology.

Section 6. Pathology, Therapeutics and Materia Medica.—F. H. Rehwinkel, Chairman, Will Taft, Secretary; F. M. Odell, Edgar Palmer, G. W. Klump, L. D. Carpenter, A. W. Smith, S. W. Dennis, C. A. Brackett, W. O. Kulp, Gorton Nichols, H. L. Sage.

Committee on Credentials made their final report, which will be found in its usual place.

Committee on Prize Essays made the following report:

Your committee would report that they have had placed in their hands one essay only, which, they are informed by its author, is the same which was rejected last year. Your committee do not feel warranted in reversing the decision of the previous committee.

C. S. STOCKTON,
C. N. PIERCE, } *Committee.*
W. H. MORGAN,

Report of Committee on Appliances was read by Dr. Fillebrown, and referred to the Publication Committee.

The special committee to revise the resolution offered by Dr. Fillebrown on colleges reported the following:

Your committee to whom was referred the proposed amendment to the Constitution relative to dental colleges, beg leave to offer the following report:

That we deem it inexpedient at this time to make any change in the Constitution relative to this subject, but would recommend the passage of the following resolution:

Resolved, That this Association disapproves of the practice of dental colleges in graduating students upon less than two full courses of lectures,

and believe it to be detrimental to the interests of dental education, and advise the omission of such inducements from their annual announcements.

Respectfully submitted.

W. H. MORGAN,
THOMAS FILLEBROWN, } *Committee.*
G. V. BLACK,

Dr. Hunt moved to refer it to Section on Education.

Dr. McQuillen amended, to adopt, which prevailed.

Upon motion of Dr. Shepard, Dr. Spalding's motion, passed yesterday, on revision of the Constitution, was reconsidered.

On Dr. Shepard's motion, it was amended by striking out the clause authorizing the committee to print.

Dr. Shepard moved that the Publication Committee be instructed to publish as many pamphlet copies of the Constitution as they might deem necessary. Carried.

Dr. Taft reported resolutions on the death of Professor Barker, which were unanimously adopted, and will be found on the memorial page.

Upon motion of Dr. Taft, a vote of thanks was tendered to the retiring officers; also, on motion of Dr. Fillebrown, to the Buffalo "Courier" and its reporter.

Upon motion of Dr. Taft, a vote of thanks was tendered to the proprietors of the hotels and the railroads for courtesies rendered.

The President appointed Drs. Crouse and Keely on the Publication Committee.

He also appointed as a Committee of Local Arrangements, Dr. Field, of Detroit; Dr. Freeman, of Buffalo, and Dr. Will Taft, of Cincinnati.

The minutes of the afternoon session were then read and approved, and the Association adjourned to meet at Niagara Falls on the second Tuesday of August, 1879.

In Memoriam.

WHEREAS, In the wisdom of Divine Providence, our colleague, Professor GEORGE T. BARKER, Vice President of this Association, has been removed by death from our midst, in the prime of his manhood; therefore,

Resolved, That we feel called upon to testify, in this manner, our appreciation of his usefulness as a member of our profession.

Resolved, That we deplore his loss, and regard his example, both professional and social, as eminently worthy of emulation.

Resolved, That the sympathy of the members of this Association be and hereby is tendered to the bereaved family of our lamented brother.

Resolved, That the above testimonial be inscribed in the minutes of this Association, and printed upon a memorial page in the Annual Transactions.

AMENDED CONSTITUTION,

ADOPTED AT SARATOGA, AUGUST, 1869.

WITH AMENDMENTS UP TO AND INCLUDING THE SESSION OF 1878.

ARTICLE I.

NAME.—This organization shall be known by the name of the AMERICAN DENTAL ASSOCIATION.

ARTICLE II.

OBJECTS.—The objects of this Association shall be, to cultivate the science and art of Dentistry, and all its collateral branches; to elevate and sustain the professional character of Dentists, to promote among them mutual improvement, social intercourse and good feeling, and collectively to represent and have cognizance of the common interests of the Dental Profession.

ARTICLE III.

SECTION 1.—MEMBERSHIP, NUMBER OF DELEGATES FROM LOCAL SOCIETIES.—Each local society may send one for every five of its active members, and each Dental College one from its faculty, as delegates to this Association, for one year, upon complying with the requirements of its Constitution; but no society shall be entitled to representation that does not adopt or substantially recognize its code of ethics.

SEC. 2.—EXPELLED MEMBERS.—Any member of this Association, being expelled from his local society, shall from that date cease to be a member of this body.

SEC. 3.—MEMBERS TO BE OF THREE CLASSES.—The members of this Association shall be of three classes, viz: Delegates, per-

manent, and honorary members; the two former classes having equal rights and privileges, except eligibility to office and membership of the sections — none being eligible to hold office except permanent members; the latter class to consist of prominent, worthy members of the dental profession residing in foreign countries, who shall be elected by ballot.

SEC. 4.— DELEGATES.— All delegates shall be practitioners of Dentistry; they shall receive their appointment only from permanently organized Dental Societies and Dental Colleges, having definite conditions of membership other than pecuniary, which shall have been approved by the Executive Committee, and a copy of which shall be in the hands of the Recording Secretary of this body.

This Association will hereafter receive no delegate, who shall, after this date, enter the profession without first having graduated at some reputable dental or medical college.*

SEC. 5.— PERMANENT MEMBERS.— Permanent members shall consist of those who, having served one year as delegates, and complied with the requirements of the Association, shall signify to the Treasurer a desire for permanent membership.

SEC. 6.— SIGNING CONSTITUTION.—Each new member, before voting or speaking on any subject before the meeting, shall sign these regulations, inscribing his name, and the title and location of the institution from which he receives his appointment.

SEC. 7.— DUES.— Five dollars shall be paid to the Treasurer by each member yearly, as dues, before he can be eligible to office, or speak or vote on any subject before the Association; and in case the dues remain unpaid at the close of the second annual meeting thereafter, the name of any such delinquent shall be erased from the list of members without further action.

SEC. 8.—GIVING NAME ON RISING.—No one shall be permitted to address the Association before giving his name and residence, which shall be distinctly announced from the chair; nor shall he speak more than twice, nor longer than fifteen minutes in all, unless by consent of the Association.

SEC. 9.—CONDUCT OF MEMBERS.—Any act of special immorality or unprofessional conduct, committed by a member of this

* This amendment takes effect from and after its adoption, session of August, 1875.

Association, shall be referred to the Executive Committee (second division), whose duty it shall be to thoroughly examine into the case, and report at the next meeting, if the charges be sustained. Whereupon, by a vote, the offending member may be reprimanded or expelled, a two-thirds vote being required for expulsion, a majority being sufficient for reprimand.

ARTICLE IV.

TIME OF MEETINGS.—The regular meetings of the Association shall be held annually, and commence on the first Tuesday in August. The place of meeting shall be determined each year by vote of the Association. After the selection of a place of meeting, there shall be appointed by the President, annually, a committee of three, residing at or near the place selected for the next meeting, whose duty it shall be to procure rooms for meetings, clinics, and for the exhibition of mechanical appliances, and to make such other local arrangements as may be needed for the Association. This committee shall act under the direction of the first Division of the Executive Committee.

ARTICLE V.

SECTION 1.—OFFICERS: HOW ELECTED.—The officers of this Association shall be a President, two Vice-Presidents, Corresponding Secretary, Recording Secretary, Treasurer, and the Executive Committee, who shall be elected by ballot without nomination. The three names, or in case of a tie, the four names, having the greatest number of votes, shall be the sole nominees in case of failure to elect on the first ballot, and a majority of all the votes cast for those names shall be necessary to a choice.

Each officer, except as otherwise provided, shall hold his appointment for one year, or until another is elected to succeed him.

SEC. 2.—PRESIDENT: DUTIES OF.—The President shall preside according to parliamentary usage, as laid down in Cushing's Manual, and the rules of order adopted by this Association.

SEC. 3.—VICE-PRESIDENTS.—In the absence of the President, one of the Vice-Presidents shall perform the duties of the office; and in the absence of these officers a chairman *pro tem.* shall be appointed by acclamation.

SEC. 4.—CORRESPONDING SECRETARY.—The Corresponding Secretary shall attend to the correspondence of the Association with the societies therein represented, and to correspondence with other scientific bodies as may be desirable.

SEC. 5.—RECORDING SECRETARY.—The Recording Secretary shall keep accurate minutes of the proceedings of the Association, preserve the archives and unpublished documents, and attend to the other duties that pertain to his office. He shall be *ex officio* chairman of the Publication Committee, and shall see that due notice is given of the time and place of meeting of the Association.

SEC. 6.—EXECUTIVE COMMITTEE.—The Executive Committee shall be the business committee of the Association, and shall consist of nine members, to whom shall be referred all business not otherwise specially provided for. They shall report at each meeting, under the proper head, their doings for the current year.

SUB-COMMITTEES.—FIRST DIVISION: COMMITTEE OF ARRANGEMENTS.—Three members of this committee shall act as the Committee of Arrangements, and shall procure suitable accommodations for the meetings and clinics, and for the exhibition and examination of appliances, of which they shall have the charge. These three shall attend generally to the wants of the Association during its session.

SECOND DIVISION: CREDENTIALS AND AUDITING COMMITTEE.—Other three shall examine and verify the credentials and qualifications of members, including all violations of the code of ethics and the constitution, and shall also be the auditing committee for that year.

THIRD DIVISION: COMMITTEE ON NOMINATIONS AND VOLUNTEER ESSAYS.—The remaining three shall examine all volunteer essays, and before they are read to the Association shall give their approval, in order that time may not be taken up by unworthy or irrelevant matter.

They shall report the names of places for the next meeting.

PUBLICATION COMMITTEE: HOW APPOINTED.—Immediately after the election of new members to the Executive Committee, two from that committee shall be appointed by the President to act in conjunction with the Recording Secretary, as the Publication Committee. They shall be authorized to employ a competent

reporter to furnish an accurate report of the proceedings of each meeting.

INSTRUCTIONS TO THE PUBLICATION COMMITTEE.—They shall superintend the publication and distribution of such portions of the Transactions as the Association may direct, or the committee judge to be of sufficient value. They shall specify in the annual report of this committee the character and cost of the publications of the Association during the year, and the number of copies still on hand.

DISCLAIMER.—This committee is hereby instructed to print, at the beginning of each volume of the Transactions, the following disclaimer, viz: "The American Dental Association, although formally accepting and publishing the reports of the various Standing Committees, and the essays read before the Association, holds itself wholly irresponsible for the opinions, theories, or criticisms therein contained, except when otherwise decided by special resolution."

REPORTS OF SUB-COMMITTEES.—Each of these sub-committees shall report from time to time, as may be necessary, to the Executive Committee as a whole, who shall decide upon such report if possible; but in case of their inability to decide upon any matter, it shall be brought before the Association for its decision as early as practicable.

CLASSIFICATION OF EXECUTIVE COMMITTEE.—At the first election of this committee, the first three shall be elected to serve three years, the second three for two years, and the last three for one year, and thenceforward three new members shall be elected each year by ballot, to serve three years, and in case of the absence of any member of this committee his place may be temporarily filled by the remaining members of the committee.

MEETINGS OF EXECUTIVE COMMITTEE.—The Executive Committee shall, if possible, meet for consultation and arrangement of their respective duties on the day preceding the annual meeting of the Association, and shall meet for the examination of credentials, the arrangement of appliances, and the reception of papers, and such other business as may properly come before them, at 8 A.M. on the day of the annual meeting.

SUBDIVISION OF EXECUTIVE COMMITTEE.—They shall also meet, after the election of new members to the committee, to choose their own chairman and secretary, and to divide themselves into sub-

committees, as hereinbefore provided, and for the purposes described.

CHAIRMAN MAY CONVENE THE COMMITTEE.—The chairman of this committee may, at his own discretion, summon the members thereof to a meeting, at any suitable hour during the sessions of the Association.

SEC. 7.—TREASURER TO ATTEND, TO RECEIVE DUES, AT 8 A.M.—The Treasurer shall hold all the moneys belonging to the Association, and shall keep an accurate account as between the society and its members. He shall attend the meeting of the Executive Committee at 8 A.M., on the day of the annual meeting, to receive dues, and shall attend at roll-call to verify the list of names, checking all such as are in arrears for dues; he shall restore such names upon payment of dues within the legal limits, and shall notify all whose names may be erased from the list of membership. He shall pay the drafts of the President, countersigned by the Secretary, upon vote of the society only, and shall report to the Executive Committee, where his accounts shall be audited, and by whom his report shall be presented to the Association, together with their own.

ARTICLE VI.

SECTION 1.—To prepare, arrange and expedite business, this Association shall be divided into six sections, as follows:

1. Artificial Dentistry, Metallurgy, and Chemistry.
2. Dental Education.
3. Dental Literature and Nomenclature.
4. Operative Dentistry.
5. Anatomy, Physiology, Histology, Microscopy, and Etiology.
6. Pathology, Therapeutics, and Materia Medica.

SEC. 2.—It shall be the duty of each permanent member to inform the Recording Secretary, before the close of the morning session of the third day of the Annual Meeting, which of the six sections he elects to join for the ensuing year. He shall be free to follow his own preferences as to the particular channel in which he will labor, but can be a member of but one section during the same year.

SEC. 3.—It shall be the duty of the Recording Secretary immediately after the close of the above morning session of the third

day, to make out lists of the names thus furnished of each section, as a basis for the election of officers of said sections.

SEC. 4.—The Association shall, by vote, assign some time after the regular election of officers of the Association, for the meeting of the several sections for organization.

SEC. 5.—When the time for the organization of the sections has arrived, it shall be the duty of the Recording Secretary to furnish some one member of each section with the list of members of his respective section, which member shall thereupon call the members to order, and read the list of names. The members shall then elect by ballot, a chairman and such other officers as they may see fit.

SEC. 6.—The chairman shall preside at all the meetings of his section. Shall exercise general supervision over the business, and shall see that the labors of his section are conducted in the manner calculated to secure the best results. The chairman, or such other member or members as the section shall select, shall prepare and read at the annual meeting of the Association next ensuing, a paper or papers on the advances and discoveries of the past year in the branches included in the section. The reading of such papers shall not together occupy more than forty minutes.

SEC. 7.—The several sections shall meet at 10 A.M. on the morning of the first day of the annual meeting of the Association.

SEC. 8.—For the information of all members, a list of the members of each section shall be published in the transactions of each year.

ARTICLE VII.

QUORUM.—Fifteen members shall constitute a quorum for the transaction of business in this Association.

ARTICLE VIII.

SUSPENDING RULES: THREE-FOURTHS TO VOTE.—This order of business may be temporarily suspended by a three-fourths vote of all the members present, for the consideration of a specific subject, upon the completion of which the regular order shall be at once resumed.

ORDER OF BUSINESS.

1. Meeting of the Executive Committee, filling of vacancies therein, examination of credentials and payment of dues, 8 A.M.
2. Meetings of the sections at 10 A.M.
3. Organization of the Association at 11 A.M.
4. Calling the roll of qualified members.
5. Reading of the minutes, and action thereon.
6. The reading and consideration of the stated annual reports from the sections, together with volunteer papers upon the same subjects, in their consecutive order.
7. Report of Executive Committee.
8. Balloting for the place of next annual meeting.
9. Election of officers and three members of Executive Committee.
10. Instructions to the Permanent Committees.
11. Unfinished, new and miscellaneous business.
12. Adjournment.

AMENDMENTS.

Alterations and amendments may be made in the foregoing Articles or Rules of Order, at any annual meeting, by the consent of all the members present. Otherwise notification in writing shall be made of any such proposed alterations or amendments, and laid over for one year for final action, when they can only be adopted by an affirmative vote of two-thirds of the members present.

RULES OF ORDER.

1. On the arrival of the hour of meeting, the President shall take the chair, call to order, and announce that the meeting is open for business.

2. No motion or speech shall be in order until the mover or speaker shall have been recognized and assigned the floor by the Chair, nor shall a motion be open for debate until seconded and stated by the Chair.

3. At the request of any member a motion shall be put in writing.

4. At the request of five members a question shall be divided, or the yeas and nays ordered.

5. When a question is under debate, no other motion shall be in order, except—1st, to adjourn; 2d, to lay on the table; 3d, the previous question; 4th, to postpone; 5th, to commit; 6th, to amend; and these motions shall take precedence in the order here stated.

6. The previous question, and the motions to adjourn, to lay on the table, and to postpone, shall be decided without debate.

7. A motion to adjourn shall always be in order, but no member can make such a motion while another is speaking, or while a vote or ballot is being taken.

8. A second amendment to the main question shall not be in order until the first is disposed of, nor shall there be an amendment of an amendment to an amendment.

9. After a motion has been seconded and stated by the Chair, it shall not be withdrawn without the consent of the Society.

10. No member shall interrupt another while speaking, except to call him to order.

11. When called to order, a member shall sit down until the point of order is decided by the Chair, or, in case of appeal, by the Society. If the point of order be sustained, the member can proceed in order by the consent of the Society.

12. Every member shall vote upon a question unless excused by the Society.

13. When any motion, except to adjourn, has been rejected, it shall not be renewed without unanimous consent.

14. Any member who voted in the majority may move a reconsideration of that question, but if that motion shall be lost or laid upon the table, it shall not be renewed without unanimous consent.

15. The President may vote with the members upon all questions, but, having so voted, shall not give the casting vote in case of a tie.

16. Motions for filling blanks shall be put in the order in which they are moved.

17. On a division, or in voting by yeas and nays, any member may change his vote before the result is declared.

18. These rules may be suspended by unanimous consent.

REPORTS

OF

STANDING COMMITTEES,

VOLUNTEER ESSAYS,

AND

DISCUSSIONS.

REPORT OF COMMITTEE

ON

DENTAL NOMENCLATURE & TERMINOLOGY.

By W. H. ATKINSON.

ON the 26th day of June, 1878, I received a letter from Prof. J. Taft, informing me that, in all probability, neither he nor Prof. Judd, the other member, and chairman of the committee, was likely to attend the coming meeting of the American Dental Association, and neither of them being able to prepare and send a report, he would throw the responsibility of that duty upon me.

In view of these circumstances, and my unwillingness to have the committee fail to perform its appointed work, I have determined to do what I can.

For a testimony of the necessity of such a work as has been imposed upon this committee, we need look no further than to the construction of the resolution, a vote upon which, by the American Dental Association, called this committee into being.

Dentistry, as an art, is, properly speaking, an applied science, in so far as it rises above the category of mere empiricism. It is the same with every art. The arts are the sciences in practice or action. As an art, dentistry has technicalities which spring up out of the mere conveniences of the workshop, which have been spontaneously applied by the workmen, and which are generally better than anything which would result from any amount of learned study on the subject. It is not desirable, nor is it proposed, to reform this kind of technicals. But there is quite another kind of technicals, which concern dentistry in common with the sciences, to which dentistry, in its scientific aspect, pertains, and of which it is a branch.

The teeth are a part of the bony structure, and the science of the teeth, as structures, is therefore a part of osteology; this, in turn, is a branch of anatomy, etc. Tracing the matter back in this manner, we come to the science of macro-physiology, of which anatomy is but a part; and thence to chemistry, mechanics, and even to astronomy and mathematics. Indeed, the fundamental universological idea that there is, at bottom, but one science, of which all the so-called special sciences are branches, is just at this time rapidly taking strong hold of the minds of the scientific world.

Seen from this point of view,—the scientific nomenclature of dentistry,—those technicalities which are not merely of the shop, are, or must become, the same as the ultimate technicalities of all science. But these technicalities of universal science, as ultimate, are not yet properly constituted into system anywhere. If they were so, we should only have to adopt them. The universologists are only laboring at them, and perhaps need as much help from us, and other specialists, as we need from them.

To give some idea of what is meant by a nomenclature applicable to all the sciences, and based on ultimate analysis, let us treat a little of the so-called atom and molecule. These are, in some sense, the very starting-points of terminology; and yet they are not adequate to meet the present demands of science. Atom is derived from Greek words which mean, *the least thing*, or, strictly, *that which is indivisible;* that, than which, there can be nothing smaller. But do we really know that there is any least thing? The word raises the query of the infinite divisibility of matter, and professes to decide the question. Still there remain two parties to this investigation, and our technicality should be one that would be equally acceptable to either party.

We may lay it down as our first business, as founders of nomenclature, if we seriously undertake that task, to keep clear of special theories in respect to the facts, and about which there is, or may be, dispute; and to confine ourselves strictly to furnishing the instruments, or that armory of vocal implements by which anybody, whosoever and whatsoever his theory or opinion, may be able, intelligibly, to present his ideas to all others.

Within a committee, working on this subject, there is no better test of their success than the selection of terms which avoid their

individual points of difference, while they obviate misunderstanding and clearly communicate the ideas of each.

To return to the word atom. There are, in its assumption, other sources of difficulty. It implies a real body, though as if it were infinitely minute. But one school of scientists denies that there are any such real bodies, and substitutes the idea of points of force. Again, the ethereal atom, affected by the tensions of electricity, as conceived by Faraday, is something many millions of times, perhaps, finer than the chemical atom, which we have already assumed to be the least thing, and indivisible. Various other difficulties are involved in the assumptions implicitly made in the meaning of the term atom. Similar difficulties not so striking affect the term molecule, since it is made up of atoms, and connotes the meaning of atoms.

We will now point out how it would be possible to evade these difficulties by discarding these terms and substituting new ones.

Universology distributes Form into four grand departments. These are:

1. Punctiform, or Form made up of Points.
2. Liniform, or Form made up of Lines.
3. Planeform, or Form made up of Planes or Surfaces; and
4. Solidiform, or Form made up of Extended Volumes, or solidities in the geometrical sense.

The domain of chemistry, histology and embryology is peculiarly punctiform; but in all these the point which is virtually what we call the atom is something more than a geometrical point. It has either a flesh-like substance, or is endowed with forces, or it is both. But still it is *like* the geometrical point; a roundish and minute entity or concept. Suppose, then, we adopt the term *punct* to mean any such roundish or point-like object or conception, without assigning to it any definiteness of any other kind; that is to say, for instance, without deciding whether it is a merely geometrical point or an atom (so called), and, if an atom, whether a body or a mere minute focalization of force, or whether it is both; and suppose that we take this root *punct* (from the Latin *punctum*, a point) as a stem upon which to build more extended and definite terms to denote the particular aspects of the idea.

For example, let us now say *punct-it* to denote a point not having any real body, and not implying any force or forces; *punct-id*,

for the so-called chemical atom, conceived of as a body of ultimate minuteness in the chemical series, and *merely as body; punct-ij*, for such a body endowed with and exerting forces; *punct-ich*, for a point without body, but exerting forces — a mere center of force; *punct-ule* for the ethereal atom, less than the chemical atom, etc. Phoneticians will perceive the appropriateness of the uses here made of the light and heavy consonant sounds, *t*, *ch*, *d* and *j*. The Greek language cannot be looked to to furnish technicalities with such minute and precise discriminations of meaning; and so we must follow the universologists in having recourse to the inexhaustible fountain-head of pure phonetics, not discarding Greek and Latin derivation, however, when it is applicable.

It is not necessary to go further, at this time, in this kind of illustration. A word should be said on the special difficulties which beset the inauguration of a true nomenclature.

1. First and foremost is the difficulty of getting completely at the bottom of the understanding of the subject.

2. Second may be mentioned the *usus loquendi*, or the prevalence of popular and unscientific expressions.

3. Individual idiosyncrasies and professional proclivities and habits, including that natural conservatism which sets itself frequently against all innovation or change.

4. Professional pedantry, which would prefer to use a learned and obscure phrase or term, defeating the understanding of the hearer, to employing a plain and simple utterance which would effectively convey the idea.

A statement of the details requisite to justify these recommendations or suggestions would really be doing the work of the whole section to which it belongs, which is quite beyond the present power of your committee, as it is a work that can only be complete after the earnest efforts of many minds for laborious years of work.

Your committee would respectfully recommend a change in the name of Section 11; from "Dental Nomenclature" to "Nomenclature, and the Correlation of Dentistry with Science at Large."

DISCUSSIONS.

Dr. JOHN ALLEN: As Dr. Atkinson has gone to the root of this subject, I shall only make a few remarks upon one or two practical points that suggest themselves to me. I think there is a great deal in our profession that requires improvement in the direction that the doctor has pointed out; for example, our nomenclature in reference to "Mechanical Dentistry." I think "Mechanical Dentistry" is a term that does not express what is embodied in the general acceptation of the term. We all know what it means, but it signifies to us a great deal more than is expressed in the simple term "Mechanical Dentistry." For example, a mechanic works by rule and scribe; he can make a thousand wheel-barrows or wash-tubs by a given design, and every one will meet the requirements for which it was intended. Not so in "ARTIFICIAL DENTISTRY," a term which I much prefer to that of "Mechanical Dentistry." We never have two cases precisely alike; each case requires some new device; therefore the dentist has to draw upon his own mind, and his artistic skill must be employed, in order to combine art with mechanism in such a degree as to meet all the cases which occur in dental practice.

The man who constructs artificial dentures should be a good physiognomist, a good physiologist and a good anatomist. He must know the origin and insertion of every muscle of the face, for it is important to raise the sunken muscles, which have become depressed in consequence of the loss of the natural dental organs, and thus restore the original contour of the face. He must employ art to do this, and his art must harmonize with the laws of nature, which should govern him in these cases. He should also carefully study expression, and many other points in the construction of artificial dentures which do not really come under the head of "Mechanical Dentistry." Therefore, I take exception to the term "Mechanical Dentistry," for the reason that it only expresses a part of what is meant to be conveyed by it.

BOSTON MEDICAL LIBRARY. AUG 1 1885

REPORT OF COMMITTEE

ON

DENTAL PHYSIOLOGY.

By M. S. DEAN, Chairman.

SINCE our last annual assembling very little has been discovered that is actually new in the domain of Dental Physiology. The modified interpretation of facts already discovered, or the more complete establishing of theories by verifying evidence, will be the chief, though not, I trust, the only, achievement of the physiologist of the present day.

The substance of the report, then, which I now offer, will necessarily strike the ear of this audience with more or less familiarity. I shall, nevertheless, endeavor to furnish, at least, some materials for your discussion and elaboration; this I believe to be one of the objects for which the Standing Committees were constituted. I will commence with

The Rudimentary or Abortive Dental Organs of the Ruminants.

You are aware that there is a wide-spread belief, which had its origin in the announcement of Goodsir, in 1838, that rudimentary incisor teeth may be found in the embryonal jaws of ruminants. This statement, founded upon certain anatomical appearances, was seized upon by Darwin, Hæckel and other scientists, to sustain their views regarding the changes that had taken place in the successive generations of animal beings, and thus the theory received additional credit and a fresh impulse until it has now become a prevailing belief that the upper jaws of the fœtal ruminants contain the germs of teeth, which, however, disappear before, or soon after, the birth of the animal.

This conclusion of Goodsir, which was never carefully verified, has recently been severely shaken, if not entirely overthrown, by the researches of Dr. Pietkiewicz, a former pupil in the laboratory of Prof. Robin.

The observations of this French histologist are recorded by Drs. Legros and Magitot, in their treatise on the *Origin of the Dental Germs, etc.*, and are supported by the testimony of these authors.* As the facts given by Dr. Pietkiewicz, in a note in the above-named treatise, may be of interest to this body, I will give a brief synopsis of them here.

He says that in attempting to verify the statement of Goodsir, which had obtained such extensive circulation and credit, he made experiments upon a series of preparations of fœtal cattle and sheep, taken in large numbers, from the earliest period of embryonal life until they had attained thirty centimeters, or one foot, in length. In this series of investigations, he not only never witnessed the presence of a dental germ, but never found even a trace of the epithelial lamina.

He further states, however, that in the commencement of his work he was led into an error by the deceptive appearance of the sections made entirely from the *anterior* portion of the jaws; for in these, he found on each side of the median line an epithelial sac, which extended from the mucous membrane into the depth of the jaw, and which *appeared* to constitute the commencement of dental germs, such as Goodsir undoubtedly conceived them to be. No difference was observed between the epithelium of this sac and that of the mucous membrane, of which it appeared to be a depression. The Malpighian layer constituted its outer investment, while in its interior was found pavimentous epithelium.

From this appearance, he thought, one could easily conceive how Goodsir might have been led into the belief that he had discovered dental germs. But in continuing to make sections from these jaws in a *posterior* direction, he found that the little sac assumed the form of a circular canal, and approached the mucous membrane of the nasal fossæ. Around this canal appeared a cartilaginous cornet, and in the upper part was a mass containing vessels. From this he recognized the organ of Jacobson. There was

* See "Origine et Formation du Follicule Dentaire chez les Mammifères," by Drs. Legros and Magitot. Paris, 1873.

absolutely nothing, he says, that could be, even remotely, compared to the germs of the incisor or canine teeth.

The above is a greatly abbreviated epitome of the description given by Dr. Pietkiewicz, but it is sufficient for the present purpose.

Professor Tomes, in his late work, makes the following corroborative statement in regard to this matter: "Some teeth have disappeared utterly; thus the upper incisors of ruminants are gone, and no rudiments exist at any stage, though statements to the contrary have been made and copied from book to book without verification."

From the foregoing it would seem that this theory, originated by Goodsir, and so generally accepted both by scientists and the people at large, must be most rigorously verified or abandoned altogether.

We will next bring to your notice the question of

Third and Fourth Dentitions.

In a recent work, Dr. Magitot, after reviewing the accounts, ancient and modern, relative to the eruption of third and fourth sets of teeth, concludes with the statement that the reports of such cases must be rejected as apocryphal, they not having been examined and reported with sufficient scientific accuracy. He considers such cases to be either the normal or the supernumerary teeth, which, though developed at the normal period, had from some cause delayed their appearance above the surface of the gums until a late period in life.

If these views are correct, we are deprived of one of the poetical illusions we had entertained of returning juvenescence in our old age.

In my own practice I have never encountered a tooth which I could class among those of the third dentitions.

A few months ago I saw a newspaper paragraph reporting a case of third dentition in the mouth of a gentleman of over seventy years of age. On communicating with a dentist who resided in the same town with the septuagenarian, I learned that the only foundation for this statement was the emergence of a root of a molar above the gum. A few days after this I saw another newspaper item, according to which an old gentleman in Brooklyn,

New York, had just erupted a third set of teeth. I instituted inquiries in that city through Dr. Cook, but no person could be found there who had even heard of this miraculous case! *

The physiological obstacles to the development of a third set are presented by Dr. Magitot as follows: "It is well known at the present day that the genesis of the dental follicle has for mechanism a series of evolutionary acts, having for point of departure either the embryonal epithelial band (as in the deciduous teeth), or a derivation from the epithelial cord of the temporary teeth (as in the corresponding permanent teeth). Now, in the case of the aged, after a total loss of these two sets of teeth, the alveolar borders are entirely deprived of all the conditions requisite for such an evolution. Nothing in the mucous membrane that clothes the jaw resembles the epithelial band from which these teeth originated; and the disappearance of all the teeth prevents any derivation from a preëxisting follicular cord.

"Now, if an eruption occurs in the jaws of a *macrobite*, the phenomenon is limited, in general, to the production of one, or at most, two teeth; and these necessarily and invariably enter the category of *tardy eruptions*." †

Although my own views in regard to these anomalies were founded entirely upon reported cases, the most remarkable of which occurred in European countries; yet they were detailed with such minuteness and apparent accuracy, that I had no doubt of their verity.

But since reading the views of Dr. Magitot, who has had such ample opportunities of observation and investigation, I shall abandon my preconceived belief until I learn of at least one well authenticated case.

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* Since the reading of this report, the following appeared in the Chicago "Times": "The Iowa City 'Press' *says that an old lady, sixty-eight years of age, living at Pleasant Valley, is cutting a complete set of teeth, above and below.*"

I regret not having been able to obtain such *positive* information regarding this case as I could desire; although, to my mind, it is sufficiently conclusive. I learn from Dr. Pearce, who, in compliance with my request, has kindly taken the trouble to investigate the facts in question; that, although he had not personally seen the lady above referred to, he had made inquiries of her sister, and other members of the family—whose observation such a remarkable event could not have escaped — all of whom pronounce the report untrue.

These three spurious cases that have come to my notice within as many months, are doubtless of the same character as those heretofore recorded as veritable third dentitions.

† See "Traité des Anomalies du Système Dentaire chez l'Homme et les Mammifères," by Dr. E. Magitot, p. 214-15. Paris, 1877.

If reports of occurrences of this nature in the *future* are as groundless as the two I have just referred to, it will be some evidence that the cases reported in distant lands and at remote periods were not examined with sufficient scientific accuracy.

It is wonderful the rapidity with which any such marvelous accounts spread, and the readiness with which they are seized upon by truly scientific persons and made to support their peculiar views. This is well illustrated in the case of one Julia Pastrana, "a celebrated danseuse, whose whole body was covered with hair, and her face adorned with a luxuriant beard."

Darwin, in support of his theory of the correlation of growth existing between the hair and the teeth, reported this woman as having *two rows* of teeth in each jaw. Afterward this remarkable case is referred to by an equally scientific gentleman, at a meeting of the Odontological Society of Great Britain, by whom Julia Pastrana is declared to have "an *excessive number* of teeth."

At a later date, reports of this celebrated case having reached the ears of Dr. Magitot, he procured impressions of the jaws of this "danseuse," and the following is his description, somewhat abbreviated: "In the lower jaw the right *canine* and the *two wisdom* teeth were wanting; in the upper jaw there were only two incisors, instead of four, and the wisdom teeth were wanting. Though the dental system was notably reduced in number, it was quite irregular, and the hypertrophied condition of the gums probably exaggerated the prognathous appearance recognized in the profile of this person."

Now, according to the first of these scientists, Julia Pastrana was endowed with *two rows* of teeth in each jaw; according to the second, she had "an *excessive* number of teeth"; while from the more minutely detailed description of the third, she had only twenty-five teeth in all,—seven less than the normal number!

I mention these discrepancies merely to show how liable are scientific men, even of the *present* day, to be led into errors in regard to the teeth; and with how much greater caution the marvelous statements of men of a much earlier day, before dentistry became a science, should be regarded.

It is to be hoped that the profession will in future search out and carefully examine all cases of anomalies of teeth that they may hear of, and report the results in our journals or our associations.

The Form or Configuration of the Tooth; is it dependent upon the Dentine-Papilla or upon the Enamel-Organ?

This is a question which, so far as I am aware, has been but little discussed, and upon which authors, not silent, generally favor the domination of the dentine-papilla.

Indeed, I had not supposed until quite recently that any physiologist entertained the opinion that the form of the crown was determined or governed by the enamel-organ. I find, however, that this theory is entertained by Dr. Magitot, in his work on *Anomalies*, just cited, though he says little in its support; in fact, he mentions the subject only incidentally, in explaining his theory of "*displacement*" or "*follicular migration.*" He there says: "It is explicitly admitted that the epithelial cord, or enamel-organ, dominates and determines the *place* and the *form* of the tooth. The genesis and development of the dental *bulb* (dentine-germ) which makes its appearance subsequently to the cord, is absolutely dependent, as a physiological consequence, upon the *presence* and *form* of the enamel-organ itself. One will, nevertheless, be tempted to believe," he continues, "that the nature of the future tooth is under the control of the dentine-papilla, a kind of organic mould upon which the calcific elements are grouped; but it must be remembered that the epithelial cord which represents the future enamel-organ always precedes the appearance of the dentine-papilla, which never originates till the cord has advanced a certain distance in its course. Accordingly, we believe that the epithelial cord decides not only the *place of genesis*, but the form and function of the corresponding tooth."

From the above quotation it will be seen that Dr. Magitot dissents from the general opinion in regard to the influence which these parts (namely, the enamel-organ and the dentine-germ) exercise upon each other.

As for myself, I had supposed that the enamel-organ was the more *passive* structure, and that its *form*, at least, was determined by the dentine-papilla.

I was strengthened in this belief by the generally recognized fact that the epithelial cord, from which the enamel-organ of the *temporary molar* is produced, is the same epithelial cord that produces the enamel-organ of the *permanent bicuspid* tooth. In this case, as is generally admitted, we have two enamel-organs eman-

ating from one and the same epithelial cord. Now, the forms of these two teeth, which originate from the same cord, are entirely *dissimilar*, the former being a molar and the latter a bicuspid. Thus originating from the same source, one would suppose that both of these teeth would have the same configuration, *if* the *form* were under the control of the epithelial cord or enamel-organ.

It is doubtless true, as Dr. Magitot has stated, that the formation of the enamel-organ precedes that of the dentine-germ. Yet it is equally true that, *until* the dentine-germ makes its appearance, the enamel-organ maintains nearly a spherical form, and the portion that is presented toward the developing papilla is *convex* instead of concave. The cap-form which it afterward assumes, must, one would suppose, result from contact with the developing papilla. From this it would appear that not only the *form* of the enamel-organ must be determined by the papilla, but also that the epithelial cells are increased in size, and modified in their character, by their contact with the dentine-germ. We find the cells, which are to compose the external and the internal epithelium of the enamel-organ, *alike* until the latter are brought into contact with the papilla; but their nature then undergoes a marked change, and this change, in the prismatic or columnar cells extends only to those that come into immediate contact with the papilla. We find, moreover, that the epithelial cells, from which the enamel and the hair are developed, are precisely the same histological elements until one is affected by contact with the developing dentine-papilla, and the other by that of the hair-papilla. These facts, if admitted, seem to favor the view that the dentine-papilla, rather than the enamel-organ, exercises an influence upon or determines the *form* of the future tooth.

But, in considering this subject more carefully, and examining both sides of the question, I discover evidence which strongly confirms the theory of Dr. Magitot. My conclusions rest mainly upon the statement of Dursy, who, according to Waldeyer, says that "the first germ of dentine appears in the dental *saculus*, as a dark, semi-lunar area at the bottom of the dental groove,—that is to say, of the enamel-germ,—cöetaneously and continuously, with which it is developed along each half of the jaw. At certain points, corresponding to the position of the subsequent teeth, the young structure develops in the form of papillæ, projecting against the

enamel-germs, while the remainder atrophies. The two horns of the semi-lunar mass (as seen in section) extend from the base of the dental papilla some distance upward, and embrace the dentine-germ and enamel-organ."

The particular point in this statement of Dursy to which I wish to call your special attention is that referring to *the semi-lunar area* of tissue extending along each half of the jaw, and from which the dentine-germs are developed.

If the anatomical description of Dursy is true (and I am not aware that it is disputed), it solves a question which has heretofore given me much difficulty, namely, *how* the enamel-organ and the dentine-germ, originating in distant tissues, never fail to meet each other.

Admitting this statement of Dursy,—that a membranous sheet extends along each half of the jaw,—this difficulty vanishes; for the enamel-organ cannot fail to come in contact with some point of this area in its descent in the embryonal tissue, and the fecundating influence of the enamel-organ would result in the development of a dentine-germ at this point of contact.

Now, according to this theory, a dentine-germ may be developed from any point of this semi-lunar area which may be reached by the enamel-organ. No *particular* point is assigned to the development of any *especial* dentine-germ: that is entirely accidental, and depends upon the course which the enamel-organ takes.

For example: If the epithelial cord of a cuspid should deviate from its normal course so as to come in contact with this *dentinal sheet of tissue* at a point between the bicuspids, the cuspid would be developed between the two teeth. In fact, whatever point in this tissue the enamel-organ of the cuspid should reach, the future tooth would be a true cuspid.

If this be admitted, the theory of Dr. Magitot must be true,—that the *enamel-organ determines* the *form* and *character of the future tooth.*

If the fact that the teeth of certain fishes are wholly destitute of enamel *seems* to militate against this theory, we have the statement from high authority that all teeth, whether clothed with enamel or not, are, in the formative stage, universally endowed with enamel-organs.

May we not *infer*, then, that in such cases the rudimentary

enamel-organ has performed its functions when it has *incited* the development of the dentine-germ, and determined its future *form* and *character?*

I throw out these suggestions for your consideration. If they have no other value, they may stimulate to investigations in this direction, which may lead to the discovery of *truth.*

In the foregoing I have endeavored to give, in a very brief manner, the present status of a few interesting physiological questions, without fully discussing or elaborating them, or presuming to decide the points in dispute, and, I fear, without offering much that will tend to their solution.

DISCUSSIONS.

Dr. ATKINSON: I am almost inclined to go back upon my idea of making "Sections" of this Association, when I know that a committee has sent its representative here with such a report as the one we have just listened to. The only criticism I have to make is that it does not belong to the field of physiology in the ordinary acceptation of that term, but to the field of histology, which latter must always be understood before we can *truly know* anything about the former. The late discoveries in this very direction (a synopsis of which I hope to present to this body during its session) will teach us something entirely new concerning the formation of enamel. This discovery was made by Dr. Bödecker, one of the pupils of Carl Heitzman, during the last three months, and will explain very much of the ambiguity and disagreement which prevails with regard to this "epithelial cord."

I shall be able to show, from drawings which will place clearly before your eyes, the precise process which is referred to in the question, "What does give the form to the tooth?" And also to show you that it is the necessary typal bond of any physical body that gives us morphology of any living structure at all, and assert that every tooth sac has two distinct departments of its structure, denominated enamel-organ and dentinal-organ.

When the prospective uses of the tooth demand enamel, they call into exercise the proliferating power of, not "cells," but "embryonal corpuscles"—not worthy to be called *cells* in any sense;

and we wish to wipe out the term "cell" (that stumbling-block which has lain in the way ever since Virchow took the lead in histological research in Germany), to enable us to discover that when the tooth which is being built requires the type of enamel, there will be enough embryonal corpuscles converted into enamel membrane to take on lime salts that may be calcified; but I will not detain you to explain, as I shall hereafter show you the drawings. This will deliver us from the abominable nonsense of ignoring the POWER by which we all live, and enable us to see clearly that there is something before that constitutes type, and orders the elements of tissues to be placed in proper position. As to the idea of these membranes finding each other — they do not find each other any more than billiard balls find each other after you have struck them with the cue. The energy behind sends them to their destined position, according to the skill of the manipulator, and by that is the game determined.

I hope, in a very few years, if not months, we shall be able to see that what has been called "epithelium" is also a stumbling-block in our way; that we have called epithelial bodies by too many different names; that we have called simple "embryonal corpuscles" (the first differentiation of the protoplasmic mass, under the type of the organism of whatever kind it may be); we have called these "*epithelial*" *bodies*, when they are nothing but colloid masses, mere little lumps of jelly, that hold within them the potentiality or possibility of being wrought into the special kind of tissue that the type demands. It would be a very slight step to go from this report into Embryology, for all reproductions follow the laws of primary production in every instance, and all reproduction that we know anything about is embryological in its character.

REPORT ON PHYSIOLOGY.

BY J. H. McQUILLEN, OF THE COMMITTEE.

Recovery of all the Faculties in a Pigeon from which Four-Fifths of the Upper Portion of the Cerebrum had been Removed.

MONDAY, February 5, 1878, in illustration of my regular course of lectures on physiology, in the Philadelphia Dental College, I exposed the cerebrum of a pigeon, as I have regularly done each session for the past twenty years, and cut out four-fifths of the upper portion in slices, to illustrate the fact that the sensorium thus exposed could be cut, pinched or burned without any manifestation of suffering on the part of the animal. The usual phenomena attendant upon the operation followed—*i. e.* profound stupor, the bird standing motionless on the table, with eyes closed, the head sunk between the shoulders, and the feathers ruffled; when pushed, it opened its eyes and moved the body, and when thrown into the air it flew a few feet, and then, on alighting, relapsed into somnolency, with an evident obliviousness to surrounding objects, until again aroused by handling. In this condition, along with another pigeon, from which the cerebellum had been removed, it was shown to the members of the biological and microscopical section of the Academy of Natural Sciences, on the evening of that day, at the regular monthly meeting of the section. Prof. Frances Emily White, M.D., professor of physiology in the Woman's Medical College, who was present, having manifested much interest in the pigeons, I offered to send them to the Woman's College, so that she could show them to the students, with the request that an effort should be made to keep them alive, and ascertain whether the functions of the cerebrum and cerebellum would be restored. Other duties of an absorbing character so occupied my time and

attention, that I had quite forgotten the request made by me until February 28, when a note was received from Prof. White, stating that "The pigeon from which the cerebrum was partially removed seems to have recovered all his faculties. He is, perhaps, less excitable than normal; seems particularly tame, but bright. . . . The other pigeon died on the third day after the removal of the cerebellum."

I at once sent for the pigeon, and was surprised at the complete recovery of the voluntary movements of walking and flying, the general manifestation of intelligence, and the fact of feeding itself and drinking as usual. There could be no question about the identity of the pigeon, as it was of a peculiar breed, and the cicatrix on the neck, where the incision had been made, so as to throw the scalp back and expose the cranium, along with a soft place in the latter, from which a portion of bone had been removed, left no doubt on that point. I again exhibited it at the monthly meeting of the Biological and Microscopical Section, March 4, and the members were surprised to find it fly about from one end of a long room and back again, feed itself, etc.

I asked them, and I repeat now the same question, How are we to account for the restoration of these functions? Is it due to the fact that the small portion of the cerebrum left after the operation assumed the functions of the entire organ, or has there been a regeneration of the part removed? Vulpian, one of the most accurate and reliable of the recent experimentalists and observers of these phenomena, positively asserts that an animal from which the cerebral hemisphere has been removed is incapable of a spontaneous voluntary movement. In this he is apparently supported by every observer, with only one exception, Voigt.

The latest author, in writing on this subject, M. Foster* (whose views may be regarded as summarizing those generally entertained), says: "When the cerebral hemispheres are removed from a bird, the animal is able to maintain a completely normal posture, and that, too, when the corpus striata and optic thalami are taken away at the same time. It will balance itself on one leg, after the fashion of a bird which in a natural way has gone to sleep. In fact, the appearance and behavior of a bird which has been de-

* "A Text-book of Physiology," by M. Foster, M.A., M.D., F.R.S. London: Macmillan & Co., 1878.

prived of its cerebral hemispheres are strikingly similar to those of a bird sleepy and stupid. Left alone in perfect quiet, it will remain impassive and motionless for a long, it may be for an almost indefinite, time. When stirred, it moves, and then on being left alone, returns to a natural easy position. Placed on its side or on its back, it will regain its feet; thrown into the air, it flies with considerable precision for some distance before it returns to rest. It frequently tucks its head under its wings; and if by judicious feeding it has been kept alive for some time after the operation, it may be seen to clean its feathers, and to pick up corn or drink water presented to its beak.* It may be induced to move, not only by ordinary stimuli applied to the skin, but also by sudden sharp sounds, or flashes of light; and it is evident that its movements are to a certain extent guided by visual sensations, for in its flight it will, though imperfectly, avoid obstacles. *Save that all signs of volition are absent;* that the movements are, on the whole, clumsy, resembling rather those of a stupid, drowsy bird than those of one quite wide awake, there is very little to distinguish such a bird from one in full possession of its cerebral hemispheres."

There is but one other case on record that I have met with, where there has been a recovery of voluntary action on the part of a pigeon from which the cerebral hemispheres had been removed. And I was not aware of that fact until the experience with my pigeon induced me to make a careful examination of the literature of the subject. I refer to the pigeon "kept alive for five months after the cerebral lobes had been, as stated by Voigt, *completely removed.* At first the pigeon presented the phenomena usually observed after this operation; but it gradually recovered, until it seemed entirely normal, with the single exception that it never would eat, all food being introduced forcibly. Five months after the operation the pigeon was killed, and the encephalic cavity was found filled with a white substance containing dark-bordered nerve-fibers and nerve-cells. Voigt never before observed anything like regeneration of the nervous substance, or so complete a restoration of the cerebral functions, and he regarded this as an

* Bischoff and Voigt, Sitzungsberichte Acad. Wiss., Munchen, 1863, pp. 479-469; 1868, page 105.

instance of anatomical and physiological regeneration of the hemispheres." Flint,* from whom this extract has been taken, goes on to say: "The objections to accepting this observation, with the conclusions presented by Voigt, are, that it is not only possible, but probable, that the hemispheres were not entirely removed, and that the posterior portion of the encephalon had advanced to occupy in part the space originally filled by the extirpated mass. While we do not assume that anatomical and functional regeneration of the cerebrum in a pigeon is impossible, it must be admitted that such an extraordinary statement as that made by Voigt cannot be accepted without reserve, merely upon the basis of a single observation."

In contrast to this case, it must be remembered that I only removed the upper four-fifths of the cerebrum. In doing this, however, the superficial gray matter of the hemispheres, recognized as the structure physiologically concerned in the exercise of the faculties of attention, perception, memory and will, was removed.

The pigeon continued in the full possession of its faculties for six months, when, in the presence of several scientific friends, it was put to death under chloroform, and a *post-mortem* examination made. On removing the scalp, a fibrous structure, analogous to the pericranium, was found occupying the place from which the bone had been taken in making the vivisection. Cutting this away, a small amount of fluid escaped, and the cranial cavity was found occupied by a white substance resembling the cerebral structure that had been removed six months before. Placing a section of this, stained with hematoxylin, under the microscope, a number of bi-polar cells, characteristic of the gray structure of the brain, were observed.

That the bird should have survived such an operation and lived for six months after, in the full possession of its faculties, is a remarkable illustration of the recuperative powers of the system. And the regeneration of the parts removed is evidence in substantiation of the case reported by Voigt. Those who may doubt these two independent cases, because they are something new and out of the usual order, should try the experiment, and observe

* "Human Physiology," by Austin Flint, Jr., M.D. New York: D. Appleton & Co., 1876, page 699.

whether they cannot obtain the same result, before calling into question the accuracy of these observations.

As Brown-Séquard, the successor to the chair of physiology vacated by the death of Claude Bernard, has justly observed, there is much to learn and unlearn with regard to the nervous system. Many of the conclusions formerly arrived at and regarded as correct beyond a question of doubt, have been proved by him to be erroneous, and a field is thus opened for investigation. Notwithstanding the anathemas against vivisections, this is the only way in which the truth can be obtained.

NOTE.—Since the above report was presented to the American Dental Association I desired the Biological and Microscopical section of the Academy of Natural Science of Philadelphia to appoint a committee to examine the pigeon's brain. The following is the report presented by the chairman of the committee, Dr. Carl Seiler:

"The specimen handed to me by Dr. J. H. McQuillen appeared to be the medulla, cerebellum, and part of the cerebrum of a bird. Intimately connected with the parts were two tumor-like growths, the one spherical and of the size of a pea, the other of irregular outline and smaller than the first. A microscopical examination of these growths revealed them to be composed of nerve-tissue, showing longitudinal and transverse sections of nerve-fibres, and in some places multipolar ganglionic cells. The blood-vessels, which in the round growth appeared to radiate from a common centre at the base of the growth, were filled with oval blood-disks."

This report was accompanied by sections of the pigeon's brain, showing under the microscope (and along with microphotographs of the same) multipolar nerve-cells, prepared by Dr. Carl Seiler.

REPORT OF COMMITTEE

ON

HISTOLOGY AND MICROSCOPY.

By G. V. BLACK, Chairman.

THE ODONTOBLASTS.

THE author of this report, in some remarks before the Illinois State Dental Society, of last year, showed the practical bearing that an intimate knowledge of the nature and functions of the odontoblasts might have on the treatment of exposures of the dental pulp. Since then the subject has engaged the attention of many observers, and has become one of peculiar interest to the dental practitioner. Heretofore these elements seem to have been studied only by a few, who were more especially interested in scientific research, but this phase of dental knowledge was not much sought by the masses of even the best practical operators.

Charles Tomes has recently written an article in which he reiterates what we said a year before, in almost the same words. Thus suddenly, as it were, this layer of cells — their physiological significance, their generation, regeneration or non-regeneration, their pathology, destruction, or the means of continuing their vitality when their life is threatened,— all have become questions of the utmost significance to every practical dentist who would be fully prepared to treat, in the wisest manner, the cases that come into his hands.

The questions which have been discussed, and may be said to have been definitely settled, are very few indeed; while those that are as yet unsettled are many, some of which are of the gravest import to the practitioner.

Our definite knowledge of the subject may be stated as follows:

The odontoblasts form one distinct layer of cylindrical cells, placed compactly side by side, covering the entire pulp surface, each of which cells sends one or more processes into the substance of the dentine, occupying the dentinal tubes. It is an admitted fact that the odontoblasts are the active agents in the formation of the dentine, and that no true dentine can be formed without them. The precise manner in which the formation takes place is a matter of discussion.

The exact shape of the odontoblasts, before post-mortem change, cannot be definitely determined from the study of the writings at our command; and the settlement of this question presents no inconsiderable difficulty, on account of the very radical differences of form presented to the observer. These shapes, as we have personally observed them, and as they have been described by others, are: 1st, A round body, three to five times as long as broad, with the pulpal end smoothly rounded or inclined to be pointed: the dentinal end distinctly fusiform for one half or more of the length of the cell, giving rise to a long, slender process — the dentinal process, or dentinal fibril. Lateral processes are also observed, given off from the cells at right angles, or nearly so, to the principal process. 2d, Pulpal end same as first form, dentinal end abruptly squared and inclined to be ragged, while the whole length of the cell is continued of one size.

Among either of these forms of cells may be found those which present pulpal processes also, to which we will allude farther on. The cells of the fully-developed tooth also present some variations of form which have been considered as a mark of the inactivity of the cell. In all these forms there is an oval nucleus, which is usually much nearer the pulpal extremity of the cell, and, in the first form, always corresponds in position with the largest diameter of the cell.

These are the forms presented to the observer. The correct determination of these, and from them deducing the true living form, is of importance; for upon the determination of this hangs, in no small degree, the determination of some other questions. For instance, if the square, ragged dentinal end be accepted as the true living form, there is nothing in it to prevent us accepting the theory of calcification presented by Tomes, for this form of the cell favors that theory. If, on the other hand, the fusiform den-

tinal end be accepted as the true living form, it furnishes a very powerful argument against that theory; such, indeed, as will necessarily, we think, lead to its abandonment, for the form of the growing surface of the dentine will in no wise correspond to the surface presented by the cells.

This question of *form* is of such importance that we will give our observations at some length. Form No. 1: The fusiform dentinal end of the cell may be demonstrated by taking a growing tooth, fresh from the mouth, with a wide, open root; drag the pulp away; a large number of the odontoblasts will be left clinging to the dentine by their fibrils; with a delicate blade these may be raised off in flakes, drawing out with them the fibrils, sometimes to considerable length. When these are examined in an indifferent medium, they will be found of the shape above described. They may be stained with carmine, or treated with acetic acid, for the better showing of the nucleus without material change of form; but they must not be subjected to the action of an acid, nor to any of the ordinary hardening processes, before being removed from the tooth — certainly not before the removal of the pulp — otherwise they will be found of the second form described, having square dentinal ends.

We have found the squared dentinal end always presented in those sections where acid reagents had been used for any purpose previous to the cutting of sections; hence in all such sections we meet with this form of the cell, which we suppose to have been the case with other observers. In this case the cell is of nearly uniform size throughout its length. We have in our possession some sections of the teeth of the common garter snake, cut diagonally across, in which the undisturbed ends of the odontoblasts may be seen lying squarely against the dentine and their fibrils projecting into it. There seems to have been just enough shrinkage for the outlines of each cell to be plainly distinguished, or there is an intercellular substance that takes a darker stain with carmine. We incline to the former view, for the reason, if nothing else, that if such intercellular substance existed it would probably take a lighter stain.

None of these forms are original with us, they have been observed and figured by others; but their relations and significance seem not to have been discussed. It is a significant fact that

throughout our researches the fusiform dentinal end has always presented itself when we have used the perfectly fresh specimen without the use of acid reagents or hardening processes, and that the squared dentinal end has as uniformly presented itself when we have used acids or other hardening processes.

This would seem to argue, in the strongest manner, that the fusiform dentinal end is the normal living form, and that the squared dentinal end is the result of post-mortem change. But for the fact that other observers of eminent ability, in whose judgment we place great confidence, have considered the squared end as the true form, we should undoubtedly have accepted the fusiform end as the true form without question. What could bring about the change in either case? These can be neither normal nor abnormal differences, but must be post-mortem differences. We have repeatedly observed both of these forms in the same individual. We have been unable to imagine any force that could be brought to bear to change the squared end into the fusiform end. Then what has changed the fusiform into the squared end? We have imagined that it might be the coagulation of a substance that existed between the cells and the dentine or among the fusiform ends of the cells. If this were true, it seems a little remarkable that this coagulated material should so grasp the cells as to continue their size and at the same time show no trace of its junction with the cell, even under carmine-staining. We have looked in vain for this mark that would prove coagulation. The continuance of the size of the cell seems to belong to the cell itself. A second possible cause for this transformation is in the flattening of the ends of the cells against the dentine by the forcible expansion of the tissues of the pulp by the acid reagent, and their becoming *fixed* in this form. It is well known how susceptible these or any other similar cells are to change of form under pressure. My observations on this point would seem to show that the cell in the one case *is longer* than in the other. Yet this change of form has occurred when I had thought the conditions were such as to allow of the free expansion of the pulp. And still again we have found this form of the cell in young teeth that we have cut without the aid of the decalcifying process. In these, means were employed for hardening which caused more or less shrinkage, and close scrutiny showed conclusively that the tissues of the young

pulp had been impacted into the dentine-cap, and that the tissues of the neighborhood were more or less drawn in after them, and the odontoblasts toward the brim of the dentine-cap forced more or less toward the apex, in such a manner that the dentinal process was bent twice at right angles before entering the dentine, or broken off altogether. Now, if we will remember that these cells are composed of semi-solid protoplasm, we can understand how their dentinal ends may become flattened against the dentine and their whole form changed. Farther on we will speak of the bearing of these different forms on dentine-formation.

We will now speak of the pulpal end of the cells. There are apparently two forms,—the rounded end, or inclined to be pointed, and the end armed with a pulpal process. The rounded end is most generally observed when the cells are separated from the pulp, but among these we occasionally notice a few presenting processes. These, we think, present less difficulty. We believe the real form to be the rounded end, and that these cells end just the same as do those columnar cells of specialized function, the ends of which are fixed to a basement membrane. Except that here there being no such membrane, they are fixed to the extended processes of the adjacent connective tissue cells. It is well known that, in case there is a membrane to which such cells are affixed, little cups or shallow alveoli are formed which receive the ends of the cells, as may be demonstrated in case of the ameloblasts,* and is fairly made out in some other positions. Now, the fact of there being no membrane in this case does not change the order, which is pretty distinct separation of cells of specialized function from indifferent tissues. The ends of the cells are still received into shallow alveoli formed by the expanded ends of two or more processes of the adjacent connective tissue cells. In this view of the case, which we deem sufficiently simple, the appearance of pulpal processes in the separated cells is the result of tearing off the process from the connective tissue cells, instead of stripping them from the end of the odontoblast. The appearance of these processes in sections explains itself.

As has been said, the odontoblasts are admitted to be the active

* AMELOBLAST, from AMEL, the old Saxon word for *Enamel*, and BLAST, from the Greek *Blastos*, a germ, is here used to denote the formative cells of the enamel corresponding with Osteoblast. Odontoblast. etc.

agents in the formation of the dentine. The precise manner in which this formation takes place is a matter of discussion, several theories being held by different observers:

1st. That the dentine is the direct result of the deposit of lime-salts in the odontoblasts themselves, which lengthen in proportion as they are calcified, or grow at the pulpal end, while the dentinal end is being converted into dentine, the cell retaining its original form (Tomes).

2d. That the odontoblasts are calcified as above, but that the intertubular substance results from the calcification of a secretion from the odontoblasts.

3d. That the dentine is the calcified secretion from the odontoblasts, which are not themselves calcified.

4th. That the dentine is the result of the calcification of the product of the melting down of the dentinal ends of the odontoblasts, which are themselves renewed by the formation of new cells in the contiguous portions of the pulp and their attachment to the older cells.

It is no part of our intention to present a theoretic discussion of these views of calcification, though grave objections may be urged to any or all of these views. Either of them makes the presence of the odontoblasts, in healthy function, necessary to the formation of normal dentine; therefore the destruction or impairment of the function of the odontoblastic layer prohibits the further formation of dentine until the conditions of health are restored.

The bearing of these expressions of the formation of the dentine is of much practical import; for if one cell continue in length from periphery to center of the dentine-formation, its dentinal end calcifying, and the pulpal end growing, then we have necessarily but one generation of odontoblasts, in which case we cannot reasonably suppose that provision is made for their reformation when destroyed by accident or disease.

On the other hand, if the cells form the material to be calcified, but do not themselves calcify, theoretically there would seem to be more opportunity for the bridging of small gaps by the lateral proliferation of cells; for in this case there is certainly less intense specialization of the cell than in case of individual calcification. Certainly a cell that is formed for the especial purpose of, in itself,

forming another and distinct tissue, by receiving into itself the material of that tissue as rapidly as it is itself formed, is the most highly specialized cell we can imagine. While it is possible that such a cell may have the power of proliferating its kind in the very early stages of its existence, before the real work to which it is destined is begun, we should expect that such power would not be continued in connection with the active performance of that function in which its character is so entirely changed. It is, however, a matter of the gravest doubt whether a specialized cell, in the active performance of its special function, has at the same time the power also of propagating its kind by any manner of cell-genesis. The careful study of cell-life will, we think, support this view. Our own observations, also those of other observers, seem to give the most positive proof that there is no such thing as the lineal regeneration of the odontoblasts, as held by Waldeyer and others. They present but a single layer, which, when the section is cut parallel to their length, is clear and decisive in all cases, and forming cells at their pulpal ends are never seen. All such appearances are the result of oblique section.

Our observations have furnished no example that we think can fairly be interpreted as furnishing proof of the lateral proliferation of the odontoblasts after the first beginning of the act of calcification. Nor have we seen the evidences of this in the facts detailed by others. We have been mindful of the value of a definite settlement of this question in its practical bearings on the treatment of exposures of the pulp, and have bent our energies to the discovery of facts indicating the multiplication of these cells, but so far in vain. We have indeed discovered cells presenting two nuclei plainly and distinctly,—which fact has also been noticed by others, and has been interpreted as furnishing evidence of multiplication by fission. We deem this a grave error, for the following reasons: When we examine the dentine we find it permeated by a multitude of dentinal tubes, which present bifurcations as we proceed from the pulp to the periphery. These we know have not grown from pulp to periphery, and branched out like a tree, but have grown from the periphery toward the center, and have coalesced. Now, in the beginning of the growth at the periphery, each odontoblast, with a few possible exceptions, was united to a single principal fibril. These odontoblasts are closely packed together at the periphery,

and as the surface of the pulp is lessened by the approach to the center, the number of odontoblasts is necessarily diminished. Their fibrils do not end blindly, as if the cells had simply disappeared, but we find that these fibrils have coalesced with others, constituting thereafter a single fibril.

Now, this union of the fibrils, or processes of different cells, we interpret to mean, also, that the two cells to which they have belonged have coalesced first, and become one cell; at first, with two nuclei, but very soon with but one; at first, with two fibrils also, but very soon with but one.

This view of the case, which is well supported by observed facts, shows the manner of the diminution of the number of the cells, but utterly fails to give any encouragement as to the regeneration of lost cells.

Now, if we go back and study closely the cells of the pulp just before and while the odontoblasts are forming, we think one cannot fail to conclude that the latter are specialized from the superficial cells of the former, without any such thing occurring, even here, as lateral proliferation. Sections prepared by us seem to show the following facts: In an early stage of the development of the pulp the ends of the ameloblasts are applied directly to its surface, to which they seem to be very loosely attached, though sufficiently so to cause some stretching of the tissues in pulling them apart, as we have often observed under the dissecting microscope.

Just before the commencement of calcification, and even before the odontoblasts make their appearance, the ameloblasts and the tissues of the pulp are separated by a well marked double pellucid layer, which in section appears as a double band, belonging about equally to the enamel side and to the dentine side of the very distinct line of demarkation between what is to become these two tissues. By careful ammonia-carmine staining this pellucid double border is brought very clearly and sharply into view, as it does not take the color. Its real width is not easily determined, for the reason that it is subject to variations by the handling of the sections. It is clearly jelly-like, and may be stretched widely, or so crushed together as to disappear entirely. This nature of the material is well illustrated in some of our sections, in which the double band is partially separated; the two parts hanging together

by points of more or less width, not separated, but very much drawn out. Now, lying more or less out into this pellucid band or layer of the pulp, a layer of cells may be seen, not differing at first from neighboring cells. Upon these, by careful work with a good power of six or eight hundred diameters, delicate processes may be seen pointing out into the clear band directly toward the junction or line of demarkation between the future dentine and enamel. As the point of calcification is approached, these cells are rapidly enlarged, for a time maintaining a somewhat rounded form, but soon stretching out into the form of the odontoblast. And as soon as the full form has been attained, we find that calcification has begun.

Now, if these observations are correct, they would seem to show that all the odontoblasts are formed by differentiation from the cells of the pulp, and enter at once on the performance of their special function. In this case, if the before-mentioned theory as to cell-genesis be correct, there is no such thing as the lateral proliferation of odontoblasts at any time. The odontoblasts are developed partially within the pellucid zone; that is, it reaches back a little more than one-half their length, inclosing their attenuated dentinal ends. As to whether this condition is maintained throughout the progress of calcification, cannot be proven or disproven by our present means of research, on account of the changes before alluded to in the form of the odontoblasts, in which case the pellucid stratum does not appear.

Whether this disappearance is the result of the means employed for obtaining the sections, or whether it is really only a temporary condition, must for the present remain a conjecture.

Examinations of secondary formations of dentine afford us the only opportunity of positively determining that the odontoblasts have been reformed after having been once destroyed. This demonstration will require that the pulp of the tooth be exposed over a sufficient space for observation, and the surface of the organ destroyed in such manner as to prevent the possibility of the odontoblastic layer having escaped destruction. This must then be capped with suitable material, or treated in any appropriate way, and allowed to remain a sufficient length of time, or until the gap is found closed with calcified material. The tooth must then be removed and sections made through the new deposit

and examined for dentinal tubes. If these present themselves in such form as to leave no doubt as to their being true dentinal tubules, the regeneration of the odontoblasts will be proven. So far we have no sufficiently accurate knowledge of this having been done. True dentine of secondary growth has been found in many instances, demonstrating that cells which have ceased to be active may reassume the active state. This may occur without, or with, exposure of the pulp, under the condition of excitement occasioned by abrasion or other influence. But we cannot assume that because there has been an exposure of the pulp the odontoblasts have been destroyed. To be sure of this, we must see that the surface of the organ has been destroyed, and this beyond the possibility of a doubt.

We have collected a considerable number of secondary deposits that have been found blocking up exposures of the pulp, in which more or less inflammation had been known to have existed; and it has been our misfortune thus far not to have found one of these that could be regarded as a physiological formation; while the majority of them are not dentine at all, but a mass composed of united calcospherites, or an infiltration, apparently of lime salts, into the indifferent tissue of the pulp, either of which we must regard as pathological formations. In some cases we have found a portion of the mass formed of true dentinal tissue, which has usually corresponded with the more central part of the exposure, with either a clear indifferent calcification or calcospherites at the margins, and a failure of continuity with the margins of the exposure.

This has happened in many cases in which, before making the sections, we supposed the fusion was perfect. Some of these cases are very interesting. Some, which we have found blocking up this class of exposure, show in their central parts some very well formed dentine, although irregular, while others are very nearly perfect dentine until the margin of the exposure is almost reached, and is bordered by a margin of calcospherites, and complete failure of fusion with the margins of the exposure exists. In two instances we have found perfect fusion with the margins, with a continuation of tubules from the pre-existing dentine into the new at one or two points, while fusion failed around the principal portion of the margins. Such points have been determined by fre-

quent examinations with the microscope during the progress of the grinding.

We should judge from the appearance of these formations that the inflammation that had existed had caused swelling of the pulp, which caused it to protrude slightly through the breach in the dentine, the sharp margins of which have wounded the pulp, possibly caused slight ulceration, thus destroying a circle of the odontoblasts of more or less extent, and that the cells thus destroyed have never been reformed; hence the failure of fusion between the new and the old formations, aptly illustrating the inability of the odontoblasts to bridge a gap of even less than the one-hundredth of an inch by lateral proliferation.

The question naturally arises, in this connection, as to whether the odontoblast may not be differentiated or reformed from the cells of the pulp. This is evidently the source from which we should expect their reformation, but the number of cases which we have examined in which this has not taken place, where the conditions would seem to have been favorable for such reformation, certainly shows that we need not expect it in very many instances. We have never seen but one instance in which such a result seemed to be illustrated, and that we will give presently for what it is worth.

We have seen some cases in which the pulp had been covered in for from eight to ten years, remaining apparently healthy, in which considerable calcifications had taken place without a trace of true dentine,— but finally these pulps had died.

Certainly it seems that, in cases where the pulp had remained so long in apparent health, a new layer of odontoblasts would have been formed, if we have a right to expect them in any case, yet such reformations did not take place. These deposits seem to be the result of an effort of the tissues of the pulp to vicariously reform parts to fill a breach in the integrity of the tissues, in the absence of the true dentine forming cells.

Still we cannot regard such reformations of the cells from the adjacent tissues as impossible, and we have found one case which seems to us to illustrate such reformation. The specimen is altogether a novel one. The new formation was $\frac{14}{100}$ of an inch in length, about $\frac{8}{100}$ of an inch in breadth, and $\frac{7}{100}$ of an inch in thickness. It was continuous with the margins of the exposure at

one point, the tubes of the old continuing into the new. At all other points there was entire failure of union, as was determined during the grinding. Many parts of the new tissue were clear, presenting no tubules whatever, but at intervals there were tufts of very fine tubes, which concentrate and coalesce into one, forming a true dentinal tube a little larger than the ordinary, which pursues a tortuous course in a centric direction, as far as can be traced in the section which is not cut just parallel with their course. These tubules seem to have their origin within the newly formed tissue, not immediately at its peripheral margin. If this be accepted as a fact, then the specialization of odontoblasts from the cells of the pulp in adult life may be considered as demonstrated. If these had had their origin from the primary odontoblasts the tubes certainly would not have arisen in the midst of the newly formed tissue, but near its peripheral margin.

Furthermore, on examination of the walls of the pulp chamber, there appear evidences of the destruction of the odontoblasts of the region, in that the tubules end abruptly, over the ends of which a clear material seems to have been deposited. At one point a large calcospherite appears in section fused into the wall. At one point in this clear margin there also appear a few of the same tufts seen in the new formation.

The case is one that had been left to nature. The patient gave a history of repeated and severe toothache, for the most part occurring three and four years previously. At the time we saw it the pulp was in a dying condition. Of course too much stress must not be laid upon a single case, and future examples may possibly suggest other explanations.

All are acquainted with those calcific deposits familiarly known as nodules. We have been in the habit of making sections of these in search of dentinal tubes, but never have been so fortunate as to find them. We believe such to have been reported by others, but we have no sufficiently definite history of them to justify us in reporting them as demonstrated. If such are found which have been formed within the odontoblastic layer, it would seem to us that the odontoblasts had been developed from the cells of the pulp in a secondary way. Yet even here there is a doubt, for the reason that some observers have reported the finding of such nodules in the pulps of developing teeth, which leads to the suspicion that

those which may show such nodules may have had their origin from cells developed at the time of the original development of the odontoblasts. We have examined the pulps of a goodly number of developing human teeth, but have never discovered such nodules among them.

WEDL states that excrescences are found on the walls of the dentine, or between it and the odontoblastic layer, which do present dentinal tubes. These, he says, may be either attached to the dentinal wall or not. We can conceive that such might occur from any disturbing cause that would throw this layer into a fold or detach the fibrils from the dentine, but how such disturbance could be brought about is the question. Yet as we have seen instances in which the odontoblastic layer seemed to have been destroyed around a portion of the surface of the pulp and comparative health of the organ resumed, we may suppose it possible that their connection with the dentine might be severed and the cells retain their vitality, and a new deposit, in the form of an excrescence, result.

From the foregoing facts it would seem evident that the reformation of the odontoblasts, if it occurs at all, is a matter of great difficulty, and can only be expected in cases of the most favorable kind. We certainly cannot expect it to occur, as a rule, from organs whose functions have become impaired from severe inflammation, or long continued irritation. Neither can we expect it from pulp surfaces that have healed by granulation, for it is not probable that we would obtain a differentiation of cells of special function from cicatricial tissue.

REPORT ON HISTOLOGY AND MICROSCOPY.

By C. N. PEIRCE, of the Committee.

THE MECHANICAL GENESIS OF TOOTH FORMS.

WE have received from Mr. John A. Ryder his paper upon the above subject, just published in the "Proceedings of the Academy of Natural Sciences of Philadelphia." In it there is so much of interest that is pertinent to the subject of dental histology, that I trust a *résumé* of the paper will prove acceptable to the association as a part of the report on Histology.

Some of the conclusions Mr. Ryder arrives at from his study of the osteology of the mammalia are as follows:

First. That in *Carnivora* and *Omnivora* the jaws were simply opened and closed during mastication without lateral movement of the mandible or lower jaw, and that the earliest and most constant type of tooth accompanied this movement; that is, that the tubercles or cusps composing the teeth do not to any extent depart from the short-rooted type with conical tubercles, styled by odontologists bunodont. That the distance apart of the series of molars of opposite sides, of both upper and lower series, was approximately alike; that is, that in closing the jaws the external or buccal cusps of the upper series were brought exactly upon a line with those of the lower, not over them, as is the case in all *Herbivora*, and to some extent in man. This condition he has styled isognathism.

Second. That in the *Herbivora* the jaws were opened and closed in mastication with extensive lateral movement of the mandible; and that the teeth were by this greatly modified in respect of their tubercular constitution, the tubercles being of the type known as crescentic, giving us the long-rooted selenodont type of tooth. That in these the width of the jaw, or the distance apart of the upper series of molars of opposite sides of the head, greatly exceeds the same measurement in the mandible, which results in the external or buccal cusps of the upper series closing over and external to the buccal cusps of the lower series. This condition he has styled anisognathism.

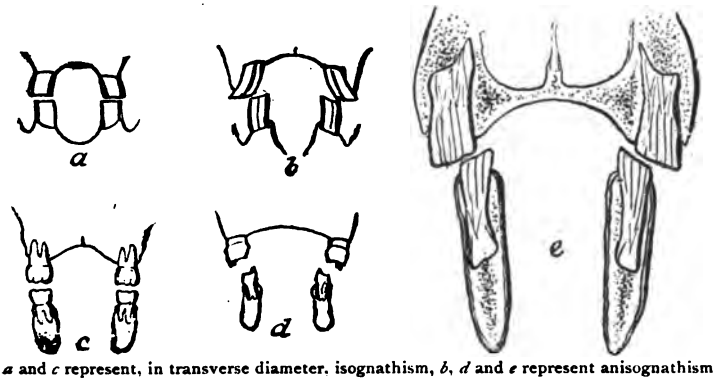
Third. That in some *Rodentia* and *Proboscidia* the mandibles were moved in a backward and forward, or antero-posterior, direction, which he has termed the reciprocating movement, with which there was also a corresponding tubercular modification, which he calls trichecodont,—three tubercles forming transverse ridges, frequently obsolete, or greatly flattened transverse lamella, composed of elongated and united tubercles soldered together by a thick cementum layer (Elephas). Isognathism is usually a characteristic of this subdivision.

Fourth. That in a subdivision including a part of *Rodentia* and *Proboscidia* (Mastodons), the movement of the mandible was both reciprocating and lateral, with a still more complex type of dentition as a result, which he has styled ptychodont,—enamel fluted and folded upon itself longitudinally and transversely. These jaws are usually anisognathous.

The foregoing groups Mr. Ryder has tabulated in the following manner:

1. No lateral movement (Omnivora)		Isognathous.
2. Lateral movement (Herbivóra)		Anisognathous.
3. Reciprocating movement	Some Rodentia Some Proboscidia	Isognathous.
4. Lateral and reciprocating movement	Some Rodentia Some Proboscidia	Anisognathous.

FIG. 1



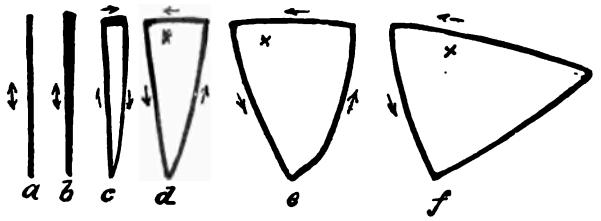
a and *c* represent, in transverse diameter, isognathism, *b*, *d* and *e* represent anisognathism.

These observations, based upon investigations made not only upon the skulls, but also upon the living animals, afford, he thinks,

the key whereby to correctly interpret the morphological history of the teeth of the higher groups, especially when brought to bear on the interpretation of the teeth of the great number of herbivorous remains which the rocks have yielded in recent times, as intermediate or antecedent forms.

The accompanying illustration is given as diagrammatically representing the figure described by the mandible, when in motion,

FIG. 2



of different varieties of animals. *a* is the figure described by the tip of the mandible of the *Carnivora* and *Omnivora*, represented by the dog and hog; *b*, a transition form, observed in the wart-hog; *c* is that described by the end of the mandible of the tapir and the kangaroo; *d* is a theoretical form, suggested for the extinct and intermediate horse; *e* is the figure peculiar to the rhinoceros, and *f*, that made by the giraffe and other ruminating animals.

The figure *a* belongs to and is characteristic of group 1, as defined above. The remaining figures, *b*, *c*, *d*, *e*, *f*, serve to characterize group 2. Groups 3 and 4 have not been illustrated, but can be easily and clearly conceived by reference to the definitions of the groups given.

The number of kinds of excursions made by the mandibular rami is limited by structural impediments, since a bar fixed at one end and free at the other, to which the mandible may be compared, is capable of but a few distinct movements. We find these to be essentially those mentioned in the definition of the four groups; few others are possible or conceivable. The first movement is the vibratory one in a vertical plane; the second is the vibratory movement in both the horizontal and vertical planes; the third is the vibration of the rami in an approximately horizontal plane, neither lateral nor vertical, but an antero-posterior or reciprocating movement, parallel to the medial axis or line; the

fourth is that which combines to a great extent the second and third. It is also to be observed that the lines described in most cases are not straight, but only approximately so, they being more or less curvilinear. With these four distinct types of mandibular movement there are as many distinct types of tooth-modification, to which almost all the forms of teeth of Mammalia yet known may be referred. The bunodont type is that characteristic of group 1, and in which the tubercles have not been modified, because there have been no movements of a proper kind to produce the modifications in the enamel foldings, as observed in the longitudinally or the transversely folded enamel crowns of the lophodonts (ridge or hill tooth). To this foregoing group 1 belong also all the haplodont types (simplest forms), as observed in the toothed whales.

According to the doctrine of mechanical dental differentiation, the foldings of the enamel in the teeth of groups 2, 3, and 4, whether they be longitudinal or transverse, are due either to the lateral or reciprocating movement of the jaws. The sub-group, selenodonts,— so called in consequence of the crescent-shaped foldings of the enamel of which the deer is a familiar example,— is perhaps the most striking illustration of all. The characteristic crescent-shaped tubercles, the author thinks, have probably been evolved by a very slow process of flattening and bending outwards or inwards of the cornu of the tubercles, due to the strains exerted in masticating the tough woody food. The movement in this case, being constantly in one direction, makes it still more probable that such has been the history of the process.

In a subsequent communication from the author, he says, "I have never yet been able to satisfy myself in regard to the direction of the motion of the ramus when the jaws are in contact, though it has occurred to me that it would make but little difference, since the obliquity of the crowns of both the upper and lower series in opposite directions would render it a matter of little consequence whether the movement were from within outwards or from without inwards, because in both cases the mechanical conditions necessary to effect the requisite differentiation would exist."

He says further, "It is, moreover, noteworthy that in no instance have I been able to discover that the plan of the enamel foldings of the teeth in any lophodont was such as not to agree with the direction and kind of mandibular movement."

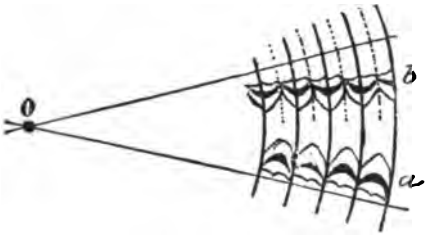
From the views advanced and the illustrations confirming them, which we have extracted from the paper in question, as well as some few which we shall yet present, the author feels that he has good and valid reasons for regarding "the condylar articulation of the mandible as the odontomorphic or tooth-shaping center,— that is, that they, the condyles, are the fulcra from whence all the dental impacts incident to mastication are controlled, giving us certain specific kinds of persistent movements which could effect modifications. The persistence of the type of movement renders its effect cumulative, whilst the addition of the factor of heredity renders it permanent."

In speaking of odontomorphic centers, the author says, "While making measurements of the skulls in the collection of the Academy some curious facts were elicited. It was observed that if a pair of dividers were taken, placing one point on the glenoid cavity of the skull or condyle of the mandible, the curvature of the cross-crests and intervening valleys of the molars of the same side would exactly coincide with that produced by a sweep of the free point of the dividers across them. The same rule was found to hold good in regard to the other side of the skull. We were not long, however, in finding that this rule was not universal among selenodonts; that there were some in which such a coincidence could not be obtained by the method described. It was then observed in these other cases that, if one leg of the dividers was placed on the posterior end of the basi-sphenoid bone, opposite to and midway between the glenoid cavities, for the superior molar series, and midway between the condyles for the mandibular molars, the arc described by the point of the free leg would now coincide in the curvature with the cross-crests and bottoms of the valleys of the molars of both sides when extended across their crowns."

For convenience, he designates the teeth the cross-crests of which coincide in curvature with arcs described respectively from the right and left glenoid cavities as centers for the molars of these sides respectively, as *biaxial;* and those where the center of this coincident arc is medial on the basi-sphenoid bone, or midway betwixt the condyle, as *uniaxial.* These centers may be named odontomorphic or tooth-shaping, since they are the fulcra which control the forces which slowly modify the shapes of the teeth and their component tubercles. The biaxial molar is by far the most

numerous, he having observed it in the following orders: *Edentata*, Proboscidians, most Rodents, *Perissodactyles*, Marsupials, and indeed most of the *Herbivora*, while the uniaxial was confined to the *Tragulidæ*, a species of deer, and a few Rodents.

FIG. 3



Ideal diagram showing the mode in which the lower molar series *a*, sweeps over the upper series *b*; the movement being constantly regulated from the mandibular articulation, or odontomorphic center, O.

The author says: "There seems to have been a metamorphosis of molars and premolars, which proceeded with greatest rapidity nearest the mandibular articulation, where the modifying forces were also applied with the greatest mechanical effect. The mandibular masticatory apparatus of mammals may be regarded as levers, in which the glenoid cavity is the fulcrum, the muscular force exerted by the masticatory muscles the power, and the resistance of the food to the teeth in crushing it the weight. Since the coefficient of muscular force is one hundred and four pounds per square inch of transverse section, it is easy to surmise what would be the tendency of the exertion of the force of many square inches in section of masticatory muscle upon the jaws and teeth in mastication. It would manifestly not be consumed in the mere comminution of the food, but it must also react upon the structures which were directly subjected to the resulting strains, viz. the teeth. In a mammal as large as the rhinoceros, the area occupied by the mandibular teeth is about five square inches, while the maxillary teeth occupy about ten square inches, as I have roughly estimated from a skull nearly adult; the ratio then of the triturating surfaces of the upper and lower series is about as one is to two. These ratios increase apparently as anisognathism increases, and conversely become equal as isognathism prevails,— that is, we may select a perissodactyl, such as the rhinoceros, or an artiodactyl,

such as the domestic ox, to represent one extreme, and the universal pig as the other."

The articulation of the mandible with the skull presents three well-marked types, viz., that observed in bunodont, with a more or less distinctly cylindroidal mandibular condyle, the selenodont, with transversely expanded and superiorly plane condyle, and the lophodonts, with a more or less nearly globular condyle, which in forms with much reciprocating movement becomes elongated antero-posteriorly, narrowed transversely, and fits, in some instances, into a well-marked, longitudinally disposed glenoid cavity. In those forms in which there is much lateral motion the rami of the mandible are also much more closely approximated than the molar series of opposite sides above; while in those forms without the excursive lateral movement there is little or no such difference in the interval between the molars of the upper and lower series respectively.

It is therefore apparent that the relations supposed to exist between mandibular movement and tooth forms must be extended so as to embrace not only changes in the form of the teeth, but also changes in the relations of the mandible and the form of their condyles and the glenoid cavities. The whole of these changes have been apparently dependent upon the mode of use of the parts and the force exerted.

It is further to be observed that those animals which have the most powerful masticating apparatus invariably have the most deeply implanted teeth, and the most effective arrangement for the replacement of tooth-structure when lost by wear.

The incisors of many animals having been lost or hypertrophied, either from the assumption of their functions by other parts, as the lips, tongue, or trunk, or by substitutions of another function, as in the case of the tusks of the Proboscidians, it would seem that mechanical resistance has much to do with their special development, as also seen in rodents.

A summary of the foregoing views the author has stated as follows:

"First. That the earliest and simplest type of mammalian jaw-movement was that in which the mouth was simply opened and closed, without mandibular excursion, and coexistent with the simple haplodont or bunodont molar.

"Second. That the development of the various kinds of excursive mandibular movement has apparently been progressive.

"Third. That as the excursive movements have increased in complexity there has been an apparent increase in the complexity of the enamel foldings, ridges and crests.

"Fourth. From the fact that the foldings, etc., have apparently been modified in conformity to the ways in which the force used in mastication was exerted, it is concluded that the various modes of crest and tubercular modification are related as effects to the diverse modes of mandibular movement.

"Fifth. It is apparent from the facts presented throughout the context that the mandibular articulations, and correlatively the whole skull, have probably been modified in shape by the movements made by the jaws and the forces exerted in executing them.

"Sixth. From the fact that incisor teeth are partially or entirely absent or relegated to another function in forms which have long prehensile tongues, mobile, prehensile lips or proboscides, it is held to be probable that such disappearance of the incisive dental elements is due to the assumption of their function by the prehensile organs indicated."

These views may also have some practical bearing upon dental science, and show that the edentulous theory advanced by our friend Dr. Thompson, based upon the degeneration of the human teeth, may have some foundation in science. The almost universal prevalence of dental caries and other dental deformities are doubtless in a large measure due to a want of a proper use of the teeth in comminuting harder food, which would be a constantly active stimulant, tending to produce a healthier and stronger development.

The long-established and increasing use of soft foods, in the light of the foregoing facts, has an unmistakable tendency to cause the teeth to become diseased, and, if there be truth in the doctrine of hereditary transmission, will in time render the human family more or less edentulous.

IN the July number of the "Practitioner," an English journal, edited by T. Lander Brunton, M.D., F.R.S., and issued by Macmillan & Co., 22 Bond street, New York, we find a very admirable article on "The Numeration of Blood Corpuscles and the Effect of Iron and Phosphorus on the Blood," by W. R. Gowers, M.D., Assistant Professor of Clinical Medicine in University College.

The accuracy of the description of the instrument for counting, made by Mr. Hauksley under his (the professor's) direction, is such that any one wishing to follow his experiments could readily do so.

With this instrument he arrives at the average normal number of red corpuscles in a cubic millimeter of blood, and also of the white corpuscles, which he states to be in proportion about as *1* white to *400* red.

Then follows the result of his experiments upon a number of patients, using *iron* and phosphorus in his efforts to remove an anæmic condition, noting the rise and fall in the number of red corpuscles as the different remedies are given or withheld; summing up with the statement that he has shown what a rapid and regular augmentation in the number of the corpuscles may be effected by iron, and that this effect is produced with perfect efficiency, by the chloroxide of iron (or dialysed iron). He says: "The manner in which the anæmia was removed is, however, not a little remarkable. The most characteristic effect of iron is believed, and rightly, to be an increase in the *hæmaglobin* of the blood — an improvement in its color. It has been denied, indeed, that it is capable of causing an increase in the number of corpuscles, but that it does increase the number is sufficiently proved by this and the following observations, confirming, as they do, those of Hayem and others. Moreover, the case shows that the primary effect of the administration of the iron may be an increase of the globules, out of all proportion to the increase in hæmaglobin, and that the rise in the latter may be accompanied by an actual decrease in the number of globules."

"Hayem rightly urges that it is not until the quality of the corpuscles is brought up to the normal, and the tint of the blood is

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NOTE.—A millimeter is 0.0394 of an inch. A meter is 39.37 inches. Diluting solutions—sulphate of soda and gum acacia.

such as corresponds to the number of normal globules, that the anæmia can be considered to be cured." "But it is evident that when such rapid increase in number occurs, we have strong reason to believe that an increase in their quality will follow, and thus the process of numeration affords a prognostic indication that the medicine given is doing good, and that the patient will regain health, an indication which is not furnished by any other method of examination."

"That a process of blood restoration, ultimately perfect, should commence with an increase in the number of globules, without corresponding improvement in their tint, shows that in laying stress on the latter, as the essential element in the cure of anæmia, we must not undervalue the former. This has been done, I think, by Hayem, in a recent paper on the action of ferrocyanide of potassium."

"He administered this drug to two chlorotic girls, and found in each a rapid increase in the number of corpuscles, without corresponding increase in the hæmaglobin." When the corpuscles had risen almost to the normal, he substituted iron; the corpuscles fell somewhat in number, but the amount of hæmaglobin increased until the 'value' of the corpuscles was that of health. Hence he concludes that ferrocyanide of potassium is quite useless in the treatment of anæmia, because it increases only the number, and leaves the 'value' of the corpuscles far below the normal,—but the changes in the blood, in the cases I have related, were almost the same, although an efficient preparation of iron was administered. The augmentation in number progressed for five weeks before any notable rise in value occurred."

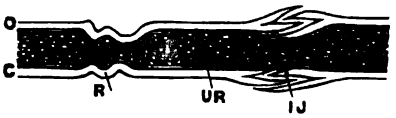
In each of his cases it is to be noted that a distinct rise in the amount of hæmaglobin occurred, amounting in one case to one-half, under the influence of the ferrocyanide, although the increase in the number of corpuscles was so great, from 3,000,000 to 5,400,000 per cubit millimeter, that the value of each corpuscle fell slightly. "It is evident, however, that each element in blood formation was stimulated, but the one out of all proportion to the other."

These facts I have brought forward here because they illustrate the need for further and more accurate observation on the mode of blood regeneration.

If there is any one thing upon which the dentist needs more systematic and thorough training, outside of his manipulative work, it is the knowledge which would fit him to deal with those stubborn anæmic cases which are so productive of neuritis.

In speaking of neuritis, a word here upon the minute anatomy of the ultimate nerve-fibre from Prof. Bolls, of Germany, may not be out of place:

He states broadly that the medullary matter is continuous, and that the outer tube or sheath is a compound, or more complex, structure, remaining after the cells from whence the nerve fiber was derived have fused, but the broken ends never become continuous, as will be seen by the above diagram, in which O C is the tube or sheath of the ultimate fiber, which is the remains of the cell from whence the contained medullary matter was derived. R is one of the Ranvierian constrictions, and IJ one of the imbricate junctions of the cells forming the sheath or tube. The medullary matter, UR, is protoplasmic neurine, and is continuous.



The Ranvierian constrictions are thought by some to be due to pathological conditions or to post-mortem changes.

While Prof. Bolls, of Germany, has been recording the results of his histological experiments, Dr. B. F. Lautenbach, of Philadelphia, has been, in a not widely different direction, making a series of experiments, the results of which were embodied in a paper presented in June, 1878, to the American Philosophical Society, entitled, "The effect of Irrelation of a polarized nerve, Pflüger's Electrionus." But previous to this presentation, a synopsis of it was given to the Microscopical Section, Academy of Natural Sciences of Philadelphia, under the title of Hemiplegia. His remarks upon that occasion were illustrated by diagrams showing the origin and decussation of the motor-fibres of the brain, the parts generally involved in hemiplegia, and explanatory of the experiments made by him in producing hemiplegia in the lower animals.

He recited a number of clinical cases in which hemiplegia did not follow destruction or removal of portions of the brain sub-

stance, and explained his experiments in producing and modifying paralysis in the lower animals by means of the continued and interrupted electrical currents, and by the injection of irritants, such as ammonia, saponine, etc.

He said that by the injection of ammonia, saponine, and other irritants, he had frequently produced hemiplegia in the lower animals, a result never accomplished in them before. The hemiplegia was persistent if the amount of the irritant was large, but temporary if small.

He concluded his remarks by affirming that hemiplegia of cerebral origin is due to polarization of the nerve fibres.

Upon inquiry as to whether these substances had been used in tetanus in man, Dr. Lautenbach replied that it had, but with only partial success. Another inquiry was made as to the results of his observations in the light of the experiments of Hitzig, Ferrier and others, to which he replied, that the motor centers located by these observers, according to his experiments, did not always exist; that he had frequently removed these so-called centers from dogs without producing sufficient paralysis to prevent them from running away.

The subject of the distribution of ciliated epithelium has within the last year elicited considerable interest, and in view of this I present the following résumé:

The term epithelium is usually applied to those cells which lie upon the surface of membranes, such as the skin or mucous membrane, and those which are found in the cavities of glands, continuous with these surfaces.

Beale says, "There are two principal varieties of epithelial cells: first, those that serve the part of a protective covering; second, those which take part in the separation or elaboration of substances entering into the composition of the secretions. In the first class may be comprised scaly, tessellated, columnar and ciliated epithelium, while the second includes the different varieties of glandular or secreting epithelium."

Ciliated epithelium has not until quite recently been recognized upon the intestinal canal of man, but the researches of Dr. J. G. Hunt, of Philadelphia, have been so successful as to satisfy him of its presence there. This being the case, a few words, reproducing

what histologists have long since accepted as correct respecting it, will not, I trust, be here out of place.

Ciliated epithelium is described as of two principal varieties, one consisting of small cells, of nearly the same length and breadth, and the other of the prismatic or cylindrical form. In origin it is, by Prof. Haeckel, Dr. George Allman and others, supposed to be developed from processes of protoplasmic substance, which first undulates, then becomes globular and elongates into a ridge, and subsequently splits into parallel bands, rapidly changing into cilia. In location it is found in the intestinal canal of the Invertebrata, sponges, polyps, echinoderms, worms, a few crustaceans and insects, and in all of the Mollusca. In some of the crustaceans and insects, in consequence of the tendency to chitinous covering and chitinous plates upon the intestinal canal, the ciliated epithelium is not found. Beale has recognized it in the human subject in the following situations: On the surface of the ventricles of the brain; on the mucous membrane of the nose, and its sinuses; on the upper and posterior part of the soft palate, and in the Eustachian tube; in the cavity of the tympanum; on the membrane lining the frontal and sphenoid sinuses; on the inner surface of the lachrymal sac and lachrymal canal; on the mucous membrane of the larynx, trachea and bronchial tubes; upon the os uteri; within the cavity of the uterus; throughout the whole length of the Fallopian tubes, and upon their extremities. With the distribution above given, which is thoroughly recognized, it is highly probable that the discovery announced by Dr. Hunt will be sustained by subsequent investigations, and that ciliated epithelium will be found to exist in the intestine of man, as well as of all the Mammalia.

VOLUNTEER PAPER ON HISTOLOGY AND MICROSCOPY.

By C. F. W. BÖDECKER.

THE DISTRIBUTION OF LIVING MATTER IN HUMAN DENTINE, CEMENT, AND ENAMEL.

As long as dry specimens were used for minute examination of the hard tissues of teeth, it was impossible to obtain clear ideas as to the presence and distribution of living matter within these tissues. Dry specimens are *mummies*, in which the basis-substance, infiltrated with lime-salts both in bone and teeth, remains relatively unchanged, but the soft tissues necessarily shrivel and fade away from the moment that a piece of bone or tooth is allowed to dry. No doubt our knowledge of the minute structure of these tissues could be increased by observing, with relatively low powers, dry specimens which have been ground thin and mounted in Canada balsam or Damar varnish. From the moment, however, that we begin to study such specimens with higher powers (about 500 diameters), our task becomes utterly unsatisfactory, inasmuch as only spaces (lacunæ, canaliculi, tubuli, etc.) can be seen, either empty or filled with air or dirt.

No one, I think, will doubt that as long as a tooth is within the jaw and in close connection with the living tissues of the body, it is alive. Morbid processes, especially caries, produce more or less painful reactions in the tissues of the tooth, even before the pulp-cavity has been invaded and an inflammatory process established. It is a daily occurrence that the cutting of apparently healthy tissue, either enamel or dentine, is a more or less unpleasant, nay, painful, manipulation for the patient, especially on the boundary between the enamel and dentine; moreover, the neck of the tooth is known to be very sensitive.

These facts, besides alterations, as produced by foreign bodies brought in contact with dental tissues, viz. fillings of any kind, show that there must be living matter present within these tissues capable of conducting sensations to the nerves of the pulp, and reacting through an inflammatory process around foreign bodies, the so-called consolidation analogous to eburnification in bone-

tissue. Many good observers were aware of the presence of living matter in the teeth,—nay, some thought of the presence of nerves within these hard tissues. All, however, failed in demonstrating the living matter in its most intricate distribution, partly owing to the wrong method applied to the preparation of microscopical specimens, and partly to a want of knowledge of the arrangement of the living matter in other tissues, especially in bone.

In 1873, Dr. C. Heitzmann *(Sitzungs-Berichte der Kaiserl. Akad. in Wien)* first discovered the minute structure of protoplasm and that of other tissues of the animal body, mainly epithelium and connective tissue. This author describes the net-like structure of the protoplasm thus: "The nucleolus is connected with the wall of the nucleus, and this again with the granules of the protoplasm, by very fine threads, which are to be regarded as the living matter of the protoplasm, while the fluid contained within these meshes of living matter does not possess the property of life." That these assertions are correct can easily be proved by close examination with a good immersion-lens magnifying at least 1000 linear. In micro-photographs this structure is plainly visible whetever a protoplasmic body is in correct focus. Several reliable German microscopists have accepted the described structure of protoplasm as a well established fact. The structure is identical in all protoplasmic formations, in the simple amœbæ as well as in colorless blood-corpuscles of vertebrates and all protoplasmic bodies (the formerly so-called cells of the tissues) of any description. The author referred to discovered, in 1873, that there does not exist a tissue within the animal body built up by isolated cells, as taught by Theodor Schwann. What was formerly thought to be a cell (a vesicle filled with a fluid and a nucleus suspended therein) has been, since 1861, through the researches of the late Max Schultze, recognized as "a jelly-like mass,—the so-called protoplasm." Since Dr. C. Heitzmann's observations, it is conceded that in all varieties of connective tissue the protoplasmic bodies being imbedded in a mucoid or a glue-giving basis-substance, at the same time are connected with each other by offshoots of the living matter, which spring from the protoplasmic body of the tissue,—the formerly so-called cell,—and traverse the basis-substance in the shape of a net-work. The net-work of living matter present in the protoplasm is identical with the net-work in the basis-substance, the only dif-

ference being that the net-work in the latter is a little wider than in the former; and further on, that in the meshes of the protoplasm there is present a lifeless fluid, while the meshes of the basis-substance contain a mucous or glue-giving substance, originating from the chemically altered and solidified protoplasmic fluid. The history of development of connective tissue illustrates the origin of both the living matter and the lifeless basis-substance — at least from the morphological stand-point — in a satisfactory manner.

In the tissue termed "epithelial" there are protoplasmic bodies closely packed together, so much so that the single bodies flatten each other, and each one shows a more or less polyhedral shape. The single epithelial bodies are separated from each other by a cloak of cement-substance, which gives the horny character to all epithelial formations. The said author demonstrated that in all epithelial bodies still endowed with life (except the dry desquamating epithelia on the surface of the body, and of certain cavities of the same) the net-work of living matter is present within the protoplasm, and sends parallel offshoots through the cement-substance, by which all protoplasmic bodies of the epithelium are uninterruptedly connected with each other. What Max Schultze, in 1864, described as thorns of the cement-substance, present in a few epithelial formations only, must be considered as products of living matter piercing the cement-substance in all epithelial and endothelial formations, though often brought to view only by the application of certain reagents.

It is evident that the old cell doctrine is not tenable. The animal body is by no means built up like a chimney or a dwelling, the bricks being represented by the cells. The organism, according to the new doctrine, for which the term "bioplasson doctrine" has been proposed, must be considered as an engine in which all constituent elements are in close contact respectively in an uninterrupted series with each other, in order to enable the whole to perform its duty. A screw, as such, may be regarded as an individual, but if put in the right place its individuality is lost; it works further on for the benefit of the whole. A single screw being loose may produce great disturbance in the action of the machine, and in an analogous way morbid action may separate protoplasmic bodies, and thus produce a great deal of disturbance,

either locally or generally, according to the dignity of the diseased tissue.

The bioplasson doctrine, thus briefly detailed, seems to me, after several months' study, very plain.

The tissue of the greatest interest to me is bone, which I studied both in the normal and dead or necrotic condition, the results of which I have laid down in the article "Necrosis" (*Dental Cosmos*, May, 1878). To enable the reader to understand what I later on intend to say on the tissues of the teeth, I propose to recapitulate briefly what I found.

The lacunæ of bone-tissue are the spaces in the glue-giving basis-substance, each of these spaces containing a protoplasmic body, with a distinctly visible net-like arrangement, to be regarded as the living matter of the protoplasm. The basis-substance of bone is pierced by canaliculi, which communicate with each other as well as with the lacunæ. I succeeded in finding a much more delicate net-work of canaliculi than observers have hitherto thought to be present.

The protoplasmic bodies, which do not quite fill the lacunæ, send offshoots of the living matter into the canaliculi, although these offshoots are plainly visible only in the coarser canaliculi. The presence of living matter in the finest canaliculi we have to assume, owing to the fact that from the whole periphery of the protoplasmic body within the lacuna there are projecting delicate conical offshoots, which spring with their basis from the protoplasmic body, traverse the light seam between this body and the wall of the lacuna, and are directed with their delicate ends toward the finest canaliculi, where they are lost to sight.

Methods.

The best method for preparation of bone-tissue for microscopical purposes is doubtless the treatment with chromic-acid solution of the strength of a half to one per cent. The same treatment has repeatedly been resorted to by different investigators of tooth-substance. I have used this solution extensively for this purpose, with precautions suggested by the experience on bone. These are, to immerse only a few teeth in a large vessel with a considerable amount of chromic-acid solution; to renew the same every third or fourth day, and add, to enforce the action of the fluid,

very small quantities of dilute hydrochloric acid. By this treatment the teeth, after a few months, become dark-green from the reduction of the chromic acid to the sesquioxide of chromium. This method is doubtless the best for softening teeth, both human and animal, when still in the jaw. Wonderful specimens can be obtained in this way by cutting bone and tooth at the same time, also for preparing specimens from embryos, in order to study the history of development of teeth. This method is highly recommended, although the chromic acid softens the cement and dentine only to a certain depth, so much so that a tooth kept never so long in the chromic-acid solution never is fit to be cut through in its whole width at one time.

The sections so obtained are ready for staining with carmine or hæmatoxylin after they have been immersed in and washed with distilled water, also for staining with chloride of gold, which latter may be done in the following way: thin sections, after having been washed in distilled water for twenty-four hours, and thus freed from the remnants of chromic acid, are to be placed in a solution of chloride of gold of the strength of half of one per cent, by means of glass rods, as metals must be avoided in the treatment with chloride of gold. These sections are to remain in the solution for a half to one hour, and must then be thoroughly washed with distilled water and exposed to daylight for several days, when they are ready for mounting in the ordinary way in glycerin diluted with fifty per cent of distilled water.

The greatest objection to the chromic-acid treatment is that enamel never can be obtained in connection with the dentine. If hydrochloric acid has been used in addition to the chromic-acid solution, the enamel is almost completely dissolved. If chromic acid alone has been used, the enamel becomes so brittle that it crumbles into small particles under the knife. Under such circumstances the outer surface of the dentine looks as if corroded, or baylike, owing to the curved lines on the boundary between the dentine and enamel.

Lactic acid acts upon teeth, if diluted sufficiently, by dissolving the lime-salts much faster than chromic acid. Specimens prepared in this way, however, in my experience, are not distinct enough for study with high powers; hence a tooth, after being softened with lactic acid, has to be immersed in chromic-acid solution for

several weeks. But the greatest objection against the use of the lactic-acid solution is the formation of mildew in a relatively short time, and the dissolving of the enamel from the teeth.

The only method which enabled me to obtain specimens of teeth provided with all hard tissues is the following: a fresh tooth, or one kept a short time in chromic-acid solution, is sliced under water by a watch-spring saw, and ground as thin as possible upon a corundum-wheel of a lathe, always being kept under water. The lamella thus obtained should be placed in a large quantity of chromic-acid solution of the strength of half of one per cent for one or two days, with the view of hardening the soft parts of the tooth and dissolving the lime-salts. After this the specimen may be stained with carmine, hæmatoxylin, chloride of gold, etc., as above described, and mounted in dilute glycerin.

The saturated solution of picric acid in water may also be used for the decalcification of a ground slice of a tooth, though the precipitated acid must be afterward removed, either by a brush or the blade of a knife. Very handsome specimens can be obtained by staining them with carmine after the treatment with picric acid.

Dentine.

We know that the basis-substance, or matrix of the dentine, is analogous to that of bone, viz., glue-giving, and at the same time infiltrated with lime-salts. We learned from the researches of E. Neumann that the basis-substance is denser on the walls of the tubuli, and more resistive to the action of strong acids, which cause the appearance of a sheath around each tubule after the solution of the intermediate substance of the matrix between the tubuli. Analogous relations also exist in bone-tissue, in which the basis-substance is decidedly denser on the walls of the lacunæ and Haversian canals.

With low powers we cannot see in the dentine anything but the tubuli, which I propose to term hereafter Dentinal Canaliculi. These canaliculi, as is well known, run in curved sigmoidal lines from the boundary of the pulp-cavity to the periphery of the dentine; they are directed obliquely upward in the crown, and assume a more horizontal direction in the region of the neck, while in the root they remain horizontal or sometimes turn downward to a varying extent. Besides the main sigmoidal curvature,

each individual canaliculus exhibits a more or less wavy course in its way through the dentine, and the individual curvatures are, as a rule, very marked on the outer periphery of the dentine.

The dentinal canaliculi reach the outer surface of the dentine only on the circumference, which is covered by enamel, while on the periphery coated by cementum, including also the neck, the canaliculi terminate before reaching the cementum, and are replaced by a fine granular basis-substance greatly varying in its width.

The distribution of the dentinal canaliculi is in the great majority of teeth uniform throughout the dentine, although exceptionally I have met with specimens of dentine in which there were smaller or larger territories devoid of dentinal canaliculi; which latter looked as if arranged in bundles or groups within the basis-substance. This relation is especially visible on transverse sections of the dentine. An irregular arrangement of the dentinal canaliculi is more common in the roots than in the crowns.

Each canaliculus contains a dentinal fiber. These fibers, when viewed with a power of 500 on good chromic acid specimens, exhibit a pale-gray color, and run through the midst of the tubuli without ramification up to the outer surface of the dentine. The outlines of these fibers never are smooth, but always look denticulated or fringed. On specimens treated with chloride of gold, the fibers and their delicate offshoots show a distinct violet color, characteristic of living matter within protoplasmic formations, while the space between the fiber and the wall of the canaliculus remains unstained, and the basis-substance between the tubuli only assumes a slight violet tinge.

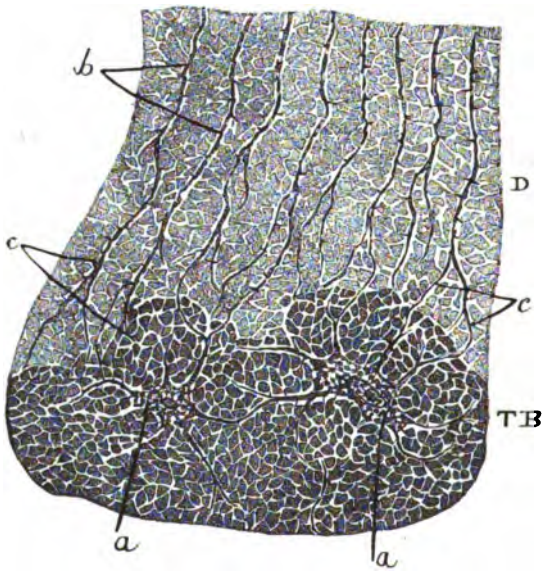
Longitudinal sections of dentine, stained with carmine or chloride of gold, if examined with high powers — from 1000 to 1500 diameters (immersion lenses) — exhibit the following:

The canaliculi of the dentine run in a more or less wavy course through the basis-substance, and are, as a rule, bifurcated only on the periphery of the dentine, both toward enamel and cementum. Each canaliculus contains a central, slightly-beaded fiber, which on its whole periphery sends delicate thorn-like elongations through the light space between the central fiber and the wall of the canaliculus. The thorns are distinctly conical, their bases being at-

tached to the dentinal fibers, and their points directed toward the basis-substance. The smallest thorns spring in an almost vertical direction from the dentinal fiber, while somewhat larger offshoots may run obliquely through the basis-substance, and directly unite neighboring fibers with each other in the vicinity of the enamel and cementum.

The basis-substance shows a distinct net-like structure. The light spaces surrounding the dentinal fibers send delicate elonga-

FIG. 1



Cross-section of root of molar. Stained with half per cent solution of chloride of gold. Magn. 1200 diam. *D*, dentine; *TB*, cement (tooth-bone); *a a*, protoplasmic bodies of the cement, branching and uniting; *b*, dentinal fibers, with their transverse offshoots; *c c*, ramification of dentinal fibers and their union with the offshoots of cement-corpuscles.

tions into the basis-substance, in which, through repeated branching, a light net-work is established, the meshes of which contain the decalcified glue-giving basis-substance. The finest offshoots of the dentinal fibers can be traced only into the mouths of the elongations of the canaliculi; on the periphery of the latter, owing to their great delicacy, the offshoots are lost to sight. Coarser offshoots of the dentinal fibers, at the localities mentioned before, traverse the basis-substance within its light net-work, at the same

time uniting dentinal fibers directly, and sending slender conical offshoots into the light net-work of the basis-substance.

The dentinal fibers are either in direct connection with coarser offshoots of the protoplasmic bodies of the cementum, or the light net-work of the basis-substance of the dentine is in communication with that of the basis-substance of the cementum.

The latter condition prevails on the periphery of the neck of the tooth, where the basis-substance of the dentine is not pierced by larger offshoots of the dentinal fibers, but only by a delicate net-work, through which the connection between dentine and cementum is indirectly established.

Where the dentine is in contact with the pulp, the dentinal fibers directly communicate with the odontoblasts (John Tomes) in a growing tooth, and with the protoplasmic bodies of the pulp in a fully developed condition, where no regular odontoblasts can be seen.

In cross-sections of dentine the dentinal canaliculi are visible in the shape of round or oblong holes; the center of each is occupied by the dentinal fiber, which has the shape of a small roundish dot. Again we see that the periphery of the dentinal canaliculus is sharply marked, and repeatedly interrupted by light offshoots leading into the light net-work which pierces the basis-substance between the canaliculi. The central fibers look very distinct and dark-violet in specimens stained with chloride of gold, and send slender, conical, radiated offshoots through the surrounding dentinal canaliculi, respectively toward the mouth of the light interruptions in their walls.

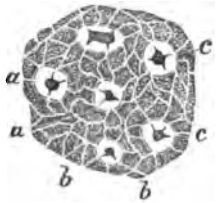
In directly transverse sections, one, two, or sometimes even three, such offshoots can be seen in a star-like arrangement. Each offshoot springs with a broad base from the central dentinal fiber, while its pointed end always is directed toward the perforation in the wall of the canaliculus, where, as a rule, it is lost to sight. Slightly oblique sections of the canaliculi exhibit both transverse and longitudinal projections of the dentinal fibers. In such an oblique section we may succeed, by cautiously changing the focus, in seeing star-like radiated offshoots up to five in number, all arising from a single dentinal fiber.

Toward the boundary between dentine and enamel, and dentine and cementum, as is well known, the dentinal canaliculi ramify,

and according to their ramifications also the dentinal fibers bifurcate, becoming thinner the nearer to the surface of the dentine. Both longitudinal and transverse sections of this part of the dentine show details identical with the main mass of the dentine, the only difference being that near the periphery of the dentine the fibers are more delicate and more closely packed together.

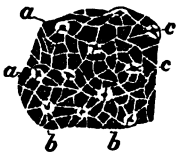
In some teeth I have met on the periphery of the dentine of the crown with the so-called "Interglobular Spaces" (Czermak),

FIG. 2



Cross-section of dentine of incisor. Stained with half per cent solution of chloride of gold. Main mass of dentine. Magn. 2000 diam. *a a*, dentinal canaliculi with the central dentinal fiber *c c*, the latter with star-like offshoots; the basis-substance between the canaliculi pierced by a delicate light net-work *b b*.

FIG. 3



Cross-section of dentine of incisor. Stained with half per cent solution of chloride of gold. View from outer periphery of dentine near enamel. Magn. 2000 diam. *a a*, dentinal canaliculi with the central dentinal fibers *c c*, the latter with star-like offshoots; the basis-substance *b b* between the canaliculi pierced by a delicate light net-work.

which may be considered as remnants of the embryonic condition of the dentine. They represent lacunæ of greatly varying sizes, bounded by curved lines, the convexities of which are directed toward the central cavity. These spaces sometimes contain protoplasm,— that is to say, embryonal elements which have not been transformed into basis-substance and not calcified. The dentinal fibers enter the protoplasmic bodies, and each fiber is united with the net-work of the protoplasm by means of delicate thorn-like projections. At other times the basis-substance of the dentine is developed within the interglobular spaces, but devoid of lime-salts. In this instance the dentinal fibers, without investment and without changing their course, pierce the basis-substance and send offshoots to this through the surrounding light spaces.

The dentine shows peculiar formations in general, though not constantly, as instanced when approaching the enamel and cementum. These formations, however, being in close relation to the covering tissues of the tooth, I prefer to describe in the chapter on cementum and enamel.

Cementum.

It has been long known that there exists a striking analogy between the structures of the cementum and bone.*

If we consider the central or pulp-canal of the tooth as a formation analogous to a Haversian canal, containing blood-vessels, nerves and medullary tissue, then the surrounding cementum corresponds to a Haversian system of ordinary bone, between which and the pulp-canal there exists an intermediate stratum of dentine.

The zone of dentine is not present all around the pulp-cavity on the apices of the roots; there the cementum, being the outermost layer of the tooth, directly lines the cavity.

Delicate parallel striations are to be seen in the cementum, identical with the lamellæ of a Haversian system, and as a rule more plainly marked near the periphery than toward the dentine. The lamellæ exhibit a more or less concentrical arrangement around the pulp-cavity, easily demonstrable on cross-sections.

Within the basis-substance of the cementum there are numerous branching spaces, in correspondence with the lacunæ of bone. The offshoots of these spaces in the cementum, like the spaces themselves, are very marked in dry specimens, because of their being filled with air. In chromic acid specimens, on the contrary, the offshoots are much less prominent, and the less, the more thoroughly the decalcification has been effected by the acid. No essential difference is noticeable between the lacunæ and canaliculi of ordinary bone and those of the cementum; in both tissues there exists a great variety as to the general arrangement, the size of the lacunæ, the number and ramifications of their offshoots.

The walls of the lacunæ and the coarser offshoots, if viewed with a highly magnifying lens (immersion, 1000 to 1500 diam.), appear interrupted on their peripheries by light spaces, which lead into a light, delicate net-work, piercing the whole basis-substance to such an extent that only the meshes have to be considered as the fields of calcified glue-giving basis-substance.

Each lacuna contains a protoplasmic body, with a central nucleus — the cement-corpuscle. The nucleus sometimes is relatively

* By some authors the dentine has been termed "Tooth-bone." It seems as if this name were applicable with considerably more propriety to the cementum; the latter term having no proper sense. The difficulty of introducing new nomenclature into anatomy, on the one hand, and the shortness of the word cementum adapting it for combinations, such as cementitis, etc., are the reasons why I retained this term.

large, and surrounded only by a narrow seam of protoplasm; while in some small lacunæ a body of the appearance of a nucleus is present without a noticeable amount of surrounding protoplasm. The net-like structure of both the nuclei and the protoplasm is plainly visible on all cement-corpuscles. From the periphery of each corpuscle conical offshoots arise, the coarser of which penetrate into the larger offshoots of the lacunæ, while the finest offshoots of the protoplasm traverse the light rim between the wall of the lacuna and the periphery of the protoplasm, being directed toward a light interruption on the boundary of the lacuna.

Cement-corpuscles, on the average, are round or spindle-shaped bodies, the long diameter of which corresponds to the direction of the lamellæ. In teeth of juvenile and middle-aged persons we meet with cement-corpuscles surpassing three or four times the size of ordinary ones, in which two or three nuclei are visible. Instead of multinuclear bodies, a number of medullary nucleated elements may fill a large lacuna, all these elements being connected with one another by very delicate threads. The longitudinal diameter of such large lacunæ is sometimes arranged radiately, therefore, vertically to the direction of the lamellæ.

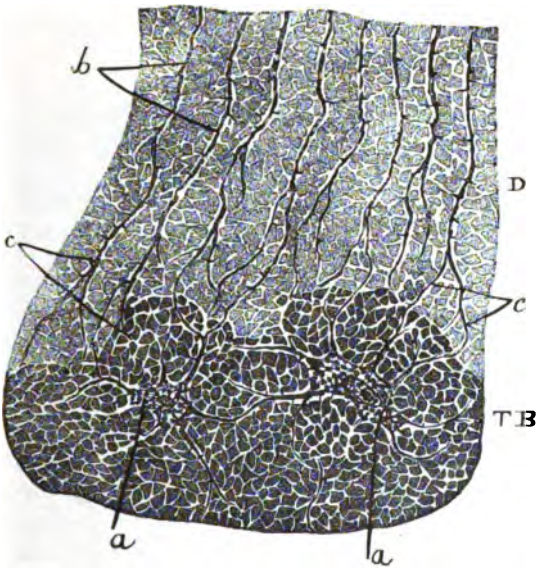
Numerous cement-corpuscles send broad and branching offshoots through the basis-substance in a vertical or oblique direction to the lamellæ, and not infrequently a direct union is established between two or three cement-corpuscles by means of such large offshoots (Fig. 4, *a a*).

In some teeth broad, spindle-shaped spaces pierce the cementum in a radiated direction, all of which contain protoplasm with delicate offshoots directed toward the net-work in the basis-substance. Nay, sometimes medullary spaces traverse the lamellæ in different directions, which, besides a varying number of medullary elements, contain capillary blood-vessels, evidently in connection with the capillaries of the periosteum. These formations may be considered as remnants of the embryonic condition of the cementum, and are never present in large numbers. All protoplasmic formations within the cementum, though greatly varying in shape, agree in being connected with each other by the delicate net-work, which pierces the basis-substance.

On the periphery of the cementum, on the line of the connection with the periosteum, the net-work of the protoplasm is usually

very broad, and the fields of the basis-substance show a prevailing globular appearance. Also, numerous spindle-shaped protoplasmic bodies are seen in connection with the cementum in an oblique arrangement, forming the transition into the structure of the periosteum. Between the calcified cementum and the striated connective tissue of the periosteum there often exists a narrow zone, occupied by closely-packed, spindle-shaped protoplasmic bodies only. In the periosteum itself there are less numerous, partly nucleated protoplasmic bodies, between which the fields of an apparently homogeneous glue-giving basis-substance are seen.

FIG. 4



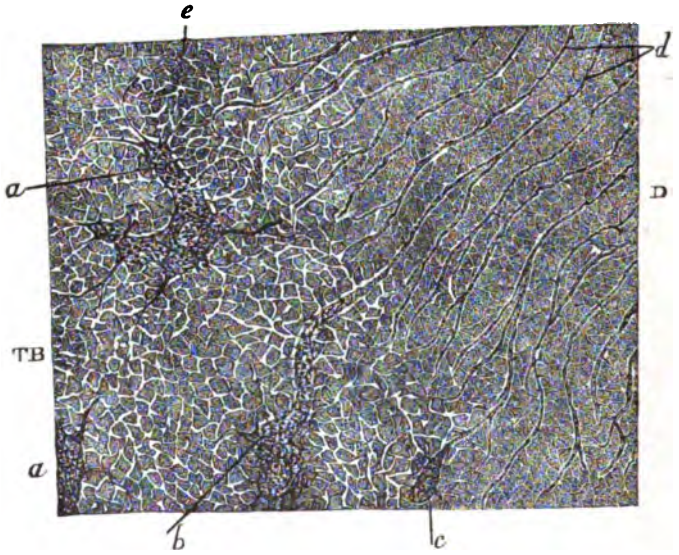
Union between dentine *D* and cement *TB*; *a a*, cement-corpuscles with large, branching offshoots, connected with each other as well as with the dentine-fibers *b*, at the bifurcation of the latter *c c*. Magnified 1200 diameters.

The connection between dentine and cementum is established either by a gradual change of one tissue into the other, without a distinct line of demarkation, or there exists a boundary formed by a more or less marked wavy line, presenting irregular bay-like excavations. Lastly, it occurs that between the bay-like excavations and the dentine there is interposed a stratum of the structure of

cementum, with a gradual change of the tissue of the former into that of the latter.

Where a gradual change takes place, the dentinal canaliculi show irregular, mainly spindle-shaped enlargements, which stand in the direction of the dentinal canaliculi themselves, or run obliquely through the basis-substance of the cementum. The distal end of such a spindle is, as a rule, in connection with a regular lacuna of the cementum, or with an analogous formation of a neighboring dental canaliculus. Many of the latter simply pass into the light, delicate net-work characteristic of the basis-substance of cementum. The dentinal fiber is in direct union with the protoplasm, which fills the spindle-shaped spaces, or it is lost to sight upon entering the net-work of the basis-substance of the cementum.

FIG. 5



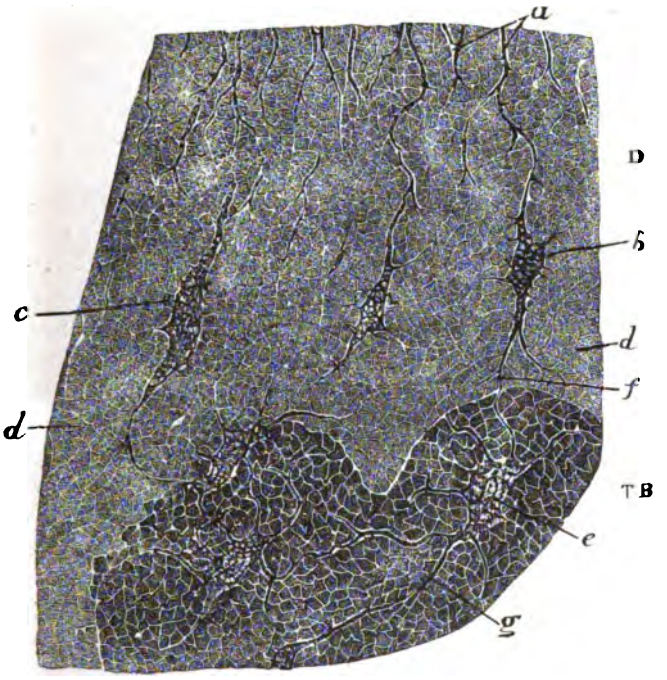
Transition of dentine *D* into cementum *TB*, without a marked boundary; *a a*, ordinary cement-corpuscles *b*, spindle-shaped large, and *c*, spindle-shaped small, cement-corpuscles, both in direct connection with dentinal fibers *d*. Magnified 1200 diameters

Where a boundary with bay-like excavations is present between dentine and cementum, spindle-shaped enlargements of the dentinal canaliculi may be seen much smaller than in the former instance. The majority of the dentinal canaliculi, however, reach the

boundary of the cementum after repeated bifurcations, by which both the calibers of the canaliculi and their central fibers are gradually diminished in size.

A connection of the dentinal fibers with the coarser offshoots of the cement-corpuscles is often observed. The light net-work of the basis-substance of the dentine always passes into that of the cementum. Not very rarely, also, on the bottom of a bay-like excavation, partly nucleated protoplasmic bodies are present, into which

FIG. 6



Transition of dentine *D* into cement *TB*, with an intermediate layer of cement structure; *a*, bifurcating dentine-fibers, in union with elongated cement-corpuscles *b* and *c*, the latter imbedded in the basis-substance *d*; between this and the regular cement, with protoplasmic bodies *e*, the wavy boundary; all cement corpuscles united with each other by large offshoots *f* and *g*. Magnified 1200 diameters.

the dentinal fibers inosculate. The connection between these and the coarser offshoots of the cement-corpuscles under these circumstances is established by such intervening protoplasmic bodies.

For the designation of the protoplasmic formations between the

dentine and enamel, and dentine and cementum, I choose the term "Interzonal layer," as first proposed by Dr. W. H. Atkinson.

Neck of Tooth.

There are certain peculiarities about the minute anatomy of the neck of the human tooth which, so far as I can judge from the literature within my reach, have not been heretofore mentioned.

John Tomes ("System of Dental Surgery," 1873), in describing the distribution of the dentinal tubes, says: "Near the neck they stop short of the cementum."

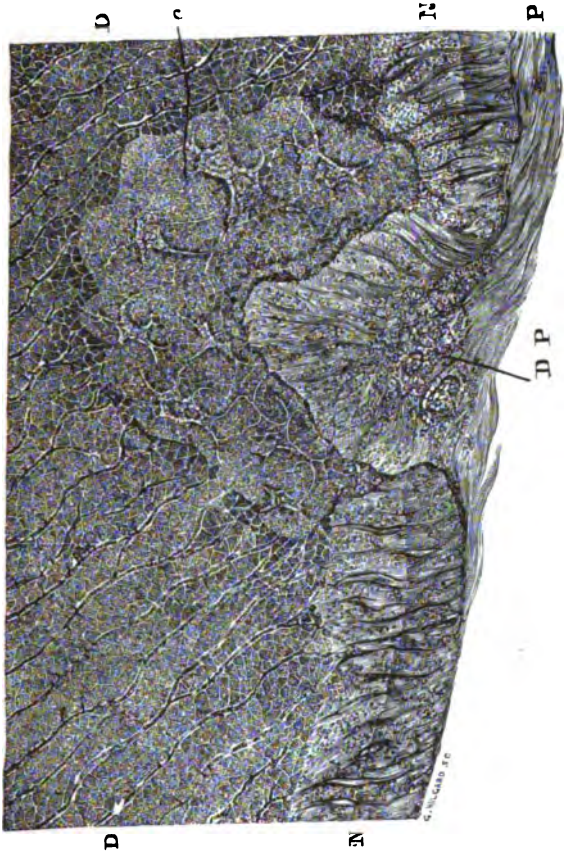
This assertion is in accordance with my own observations. In the great majority of teeth neither the canaliculi nor their contents, the dentinal fibers, reach that part of the cementum which surrounds the neck. Near the periphery of the dentine bifurcations of the canaliculi — and consequently also of their tenants, the dentinal fibers — take place, some of the finest terminations of which run to the boundary between the dentine and cementum. As a rule, the finest terminations of these fibers are lost to sight in a net-work somewhat coarser than that of the basis-substance of ordinary dentine. The minute elongations of the dentinal fibers can also be traced into the light net-work with more distinctness than elsewhere in the dentine. Sometimes the dentinal canaliculi, when approaching the periphery, become slightly dilated so as to produce slender pear-shaped cavities, in accordance with which the terminating dentinal fibers exhibit slight enlargements.

The boundary between dentine and cementum presents a wavy line, traversed by delicate threads, or occupied by spindle-shaped protoplasmic formations, all of which are in union with direct or indirect elongations of the dentinal fibers.

The cementum around the neck forms a narrow layer, which is cut off obliquely at the place of junction with the enamel. Both the cementum and enamel in this situation — being of the same width — are separated by a boundary which runs from the outer periphery obliquely downward to the dentine. This relation I found in the majority of teeth, and it is only exceptionally that I have met with cementum regularly overlapping the enamel. The cementum on the neck is built up by delicate prisms, or spindles, arranged vertically to the surface of the dentine. The prisms

represent the fields of the basis-substance, and are separated from each other by light rims, holding beaded fibers, or traversed by delicate vertical threads. In transverse sections, when the prisms are cut obliquely, they exhibit irregular opaque fields, separated from each other by light rims.

FIG. 7



Anomalous formation of cementum on the neck of a human tooth. *D D*, dentine; *N N*, cementum on neck of tooth, with spindle-shaped or prismatic fields of basis-substance; *D P*, depression in the cementum of the neck, filled with elements of periosteum, surrounded upward by a zone of regularly developed cementum. Magnified 1200 diameters.

These formations closely resemble the protoplasmic bodies of the periosteum next to the cementum, alluded to in the former

chapter; hence I do not hesitate to consider the bony formation on the neck as being produced by calcification of the osteoblasts of the periosteum. The cementum on the neck of the tooth is devoid of lamellæ and lacunæ, which appear deeper below, together with all the characteristic features of the fully developed structure of the cementum. The lamellæ become the more distinct, and the lacunæ, with their contents (the cement-corpuscles), the more numerous, the broader the diameter of the layer of the cementum.

The outer surface of the cementum is covered on its upper part with epithelial elements, in close resemblance with those of Nasmyth's layer of the enamel. This layer turns over into the epithelial coat of the gum. Farther down, the cementum, though still endowed with properties characteristic of the neck of the tooth, is surrounded by the fibrous connective tissue of the periosteum.

I have met once with striking formations on the neck of a tooth, which I consider anomalous, but not quite pathological. Here the ordinary cement of the neck is interrupted by grooves or pits containing the elements of periosteal tissue. The inner periphery of the pit is covered with a well-developed, evidently isolated, formation of cementum. The island of the cementum is broadest above the bottom of the pit, and slopes down along the walls of the pit until it is lost within the layer of the cementum of the neck.

Enamel.

The best specimens for examination of enamel I obtained by grinding fresh teeth and staining them for one hour with the half per cent solution of chloride of gold, as mentioned in the description of methods for the examination of teeth in general.

Up to this time the impression of most examiners has been that the enamel is built up by bundles of rods, or prisms, crossing each other, and traversed by faint vertical lines, which give each of them the appearance of a column, subdivided into small squares. The enamel-rods doubtless exist, and are wavy close to the dentine, and straight on the periphery and the main mass of the enamel. They may be considered as columns of a calcified substance, between which minute spaces are left, analogous to the cement-substance of epithelial formations.

FIG. 8

Longitudinal section of enamel. *a*, enamel-rods, traversed by prevailing vertical spaces; *b*. enamel-fibers, branching and partly uniting through delicate offshoots; numerous fine thorns of the fibers directed toward the light interruptions within the rods. Magnified 1200 diameters.

In longitudinal sections we see delicate beaded fibers, which occupy the central portion of the interstices between the enamel-rods. These fibers I propose hereafter to term the "Enamel-fibers."

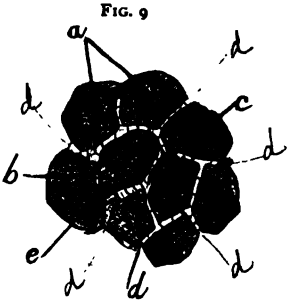
From such a fiber arise very minute conical fibrillæ, which traverse the rims between the fiber and the neighboring outlines of the rods, and fade away from the moment they enter the latter. The columns of the basis-substance themselves are pierced by delicate canaliculi, running in an almost vertical direction through the enamel-rods, regularly enough to give the appearance of squares, although these are much smaller than usually represented in the books. In the midst of a minute square light canals are seen, not infrequently running parallel with the outlines of the enamel-rod. The square fields thus produced by the rectangular crossing of light channels look, under the power of 1200 diameters, finely granular. In specimens not fully decalcified it is impossible to decide whether there is a light network within the enamel-prisms analogous to that in the basis-substance of the dentine and cementum, or whether the granular appearance is merely due to the depositions of lime-salts. In thoroughly decalcified specimens of enamel, however, such as were first made by Dr. Frank Abbott, there is no difficulty in seeing, with high powers, the reticular structure of protoplasm. I am indebted to the above-named observer for having first drawn my attention to this fact.

Cross-sections of the enamel, which we obtain also in longitudinal sections of the tooth, on account of the different directions of the bundles of the enamel-rods, plainly exhibit the irregular polyhedral fields of the enamel-rods. The light interstices between the polyhedral fields contain, in many instances, delicate-beaded fibers, surrounding the polyhedral fields of the enamel-rods. The fibers, if cut transversely, have the appearance of dots, and connect with each other directly or by means of intervening delicate threads.

Extremely fine thorns traverse in a vertical direction the light

space between two neighboring enamel-rods, even where a fiber is not visible. These threads are identical with the delicate thorns, first described by Max Schultz in 1864, in the cement-substance of epithelial formations.

FIG. 9



Cross-section through enamel. *a*, rods of enamel, partly exhibiting formations like nuclei, *b*, *c*; *d*, light interstices between the rods traversed by delicate beaded fibers *e*, or by vertical thorns. Magnified 2000 diameters.

The rods of the enamel on an average are half the diameter of the columns of the basis-substance in dentine; therefore, four columns of the former will correspond to two of the latter, and consequently two dentinal fibers will answer to four enamel-fibers. Sometimes in the cross-section of an enamel-rod I met with roundish formations occupying the center of the rod, one or two in number, which, owing to a denser granulation and a surrounding shell, have the appearance of nuclei. The enamel-fibers run a very straight course toward the surface, and are here, in the average, a trifle thicker than near the boundary of the dentine.

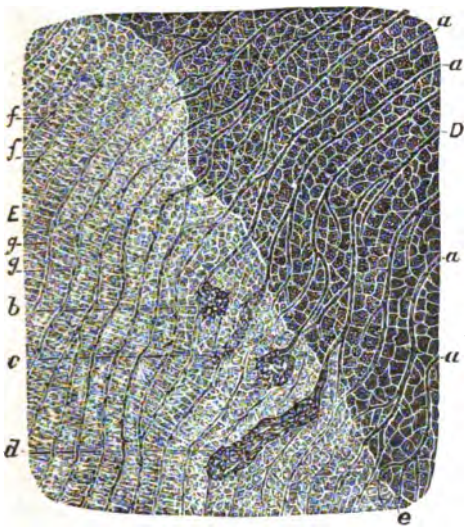
The outermost surface of the enamel is covered by flat epithelia (Nasmyth's membrane), which in the transverse section have the appearance of shallow spindles; not infrequently there also occurs a stratified epithelium on the surface of the tooth. The enamel-fibers are in connection with these epithelial bodies, which, if detached, show delicate offshoots adhering in regular intervals — the broken enamel-fibers. Sometimes the surface of the enamel is coated by a thin uniform layer of protoplasm, with regularly scattered nuclei. In such an instance single epithelia are not traceable, though scarcely any doubt can arise about the epithelial nature of this layer.

At the place of junction of the enamel with the dentine a direct connection is often seen between the enamel and dentine-fibers. The latter, through repeated bifurcations, being closely brought together, continue their course into the enamel-fibers without any interruption. The direction of the fibers of the two tissues, however, is almost never identical, inasmuch as the enamel-rods, and consequently the enamel fibers, as a rule, owing to their wavy course in this situation, are obliquely intercepted upon the dentine.

We can very often trace dentinal fibers up into the enamel in a

varying distance, without a distinct union between the enamel and dentine-fibers, as the former do not reach the surface of the dentine, but terminate above its level in different heights, while the zone close above this is occupied by a delicate, irregular net-work analogous to that of the dentine. Here no rods of enamel are visible either in longitudinal or transverse sections, but with low powers of the microscope only a finely granular layer is presented.

FIG. 10



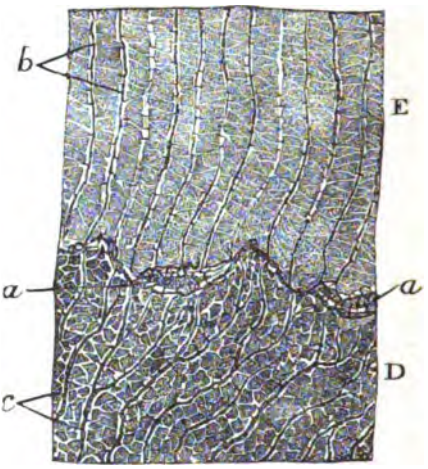
Union of dentine with enamel. *D*, dentine; *E*, enamel; *a a*, dentinal fibers, being in union with large protoplasmic bodies *b c d*, or directly running into enamel-fibers *e g*. The latter often are lost in the delicate irregular net-work on the bottom of the enamel *f f*. Magnified 1200 diameters.

In many places the dentinal canaliculi, upon entering the enamel, suddenly become enlarged, and form more or less distinctly spindle-shaped cavities of greatly varying diameters, analogous to the spindle-shaped enlargements on the boundary of the cementum. These enlargements run either in the main direction of the dentinal canaliculi or deviate obliquely. They invariably contain protoplasmic bodies, which plainly show the reticular structure, and sometimes contain one or more compact clusters to be considered as nuclei. The spindle-shaped protoplasmic bodies, on their proximate ends, are in direct connection with the terminations of the dentinal fibers which have arisen from their repeated bifurcations, while on the distal end they may show delicate fibers, viz., enamel-fibers, or delicate conical thorns, traversing the light space between the surface of the protoplasmic body and the wall of the cavity. These thorns are lost to sight on passing into the net-work at the bottom of the enamel. In some places, especially on the cusps, the spindle-shaped enlargements of the

dentine-fibers are quite numerous, and of an almost uniform size and direction, forming regular rows of spindles within the enamel. In the teeth of younger individuals, the spindle-shaped enlargements are comparatively larger and more regular than in the teeth of old people.

The boundary line between the dentine and enamel is either straight or slightly wavy, and with more or less deep bay-like excavations, analogous to those on the boundary between dentine and cementum. The concavities of the bays are directed toward the dentine. In this interzonal layer at the bottom of the bays we meet with fibers occupying the curved spaces between dentine and enamel, or we will see in a correspondingly bent direction protoplasmic bodies directly connected with the dentinal fibers downward, and with the enamel-fibers upward. In specimens stained with chloride of gold, the dentine is always much deeper in color than the enamel, hence the relations described are very plainly marked on such specimens.

FIG. 11



Union of dentine with enamel. *D*, dentine; *E*, enamel; *a a*, protoplasmic bodies on the boundary between both tissues, in union with enamel-fibers *b*, and with dentine-fibers *c*. Magnified 1200 diameters.

Results.

The details described from microscopic examination make it evident that we shall have to modify considerably the views heretofore maintained on the structure of the teeth.

Since we have known the structure of protoplasm, and that of basis-substance of connective tissue, by the researches of C. Heitzmann, we are accustomed to look for the distribution of the living matter not only in the protoplasmic bodies (the formerly so-called

cells), but also in the basis-substance, which for a long period was thought to be devoid of life.

Living matter has two main characteristic properties, viz., those of motion and reproduction. We observe contraction and extension alternately in every variety of protoplasmic formation, also the increase in size of living matter (swelling of the granules), both in the physiological process of propagation and in the pathological process of inflammation.

The net-work of living matter present in the basis-substance of connective tissue cannot, as a matter of course, be seen moving, but we observe very readily its increase after the basis-substance has been liquefied and the condition of the protoplasmic stage reëstablished, as in inflammation and new formations. In all these instances the chloride of gold is a valuable reagent for the purpose of staining the living matter in all its phases of development.

The structure of the tooth closely resembles that of bone. We know that the basis-substance of bone is traversed everywhere by a net-work of living matter, in the shape of beaded fibers, where they form larger offshoots of the protoplasmic bodies. In bone-tissue the presence of living matter is plainly demonstrable by observation of living and of chromic-acid specimens, both in physiological and pathological conditions.

Comparison of the tissues of teeth and bone shows that a tooth, as long as it is in connection with the living organism, is alive, and contains a great amount of living matter. The sensitiveness of all the tissues of the tooth, the phenomena of growth, the results of inflammation, etc., all strongly indicate the presence of living matter within the tooth, and this I have proved in fresh teeth, in those treated with chromic acid and stained with chloride of gold.

1st. The dentinal canaliculi are excavations in the basis-substance of the dentine, each containing in its center a *fiber of living matter*. Besides the dentinal canaliculi, there exists an extremely delicate net-work within the basis-substance of the dentine, into which innumerable offshoots of the dentinal fibers pass. Although we cannot trace the living matter throughout the whole net-work in the basis-substance, evidently owing to its delicacy, we are justified in assuming that not only the dentinal canaliculi, but the whole basis-substance of the dentine is also pierced by a delicate net-work of living matter. The living matter of the dentine is in direct

union with that of the protoplasmic bodies of the pulp, of the cementum and of the enamel.

2d. The cementum, as well as ordinary bone, is provided with lacunæ and canaliculi. The lacunæ contain nucleated protoplasmic bodies, and the canaliculi hold offshoots of the living matter of the protoplasm. The whole basis-substance of the cementum is traversed by a delicate net-work, which in all probability contains living matter, though this is traceable only in its thorn-like projections from the periphery of the protoplasm and its larger offshoots. The living matter of the cementum is uninterruptedly connected with that of the periosteum, and continuous with the living matter of the dentine, either through intervening protoplasmic bodies in the interzonal layer or directly with the dentinal fibers.

3d. The cementum covering the neck of the tooth is devoid of lamellæ and protoplasmic bodies. It is built up by directly ossified osteoblasts of the periosteum, presenting their prismatic shapes, and everywhere traversed by a net-work of living matter. This is in connection either with the epithelium of Nasmyth's layer or the periosteum, and with the dentine mainly through the intervening net-work in the basis-substance of the latter.

4th. The enamel is traversed by fibers of living matter located in the interstices between the enamel-rods. The fibers are connected with each other by delicate fibrillæ, piercing the enamel-rods in a vertical direction. Besides these rectangular unions the basis-substance is traversed by a minute net-work of living matter. The enamel-fibers send conical thorns toward the enamel-rods, and such thorns are visible in all interstices between the enamel-rods. The enamel-fibers are continuous on the outer surface with the covering layer of flat epithelia, and on the inner surface with the dentinal fibers. The latter connection is either direct or indirect through a net-work of living matter, or through intervening protoplasmic bodies in the interzonal layer.

REPORT ON HISTOLOGY AND MICROSCOPY.

By G. F. WATERS, of the Committee.

By reference to the Transactions of the American Dental Association for 1877, page 43, discussion of Dr. Dean's paper on Dental Physiology, it will be seen that I referred to some strange appearances found within a cavity (in a section) of a tooth. Fig. 1 of the accompanying plate gives a view of this portion of the section enlarged forty diameters, and having some portion of the contents idealized at eighty diameters. This cavity was in the enamel, in the grinding surface of the palatal portion of the crown of the first left superior molar, and opened from a sulcus into which small particles of food, during mastication, were naturally forced; subsequent fermentation would displace some of the impacted mass only to be replaced again at the next meal. This series of operations had continued for forty years, when the tooth was extracted, so that the penetration of the enamel and formation of the cavity were very gradual.

As we look into this cavity we desire to know what and from whence are these curious bodies. In pursuing an investigation for the purpose of elucidating these questions, we naturally first look to the various kinds of food that have been ground upon the tooth, and in them we find forms that very nearly, if not exactly, correspond with those found in this cavity of decay; and we shall be surprised at the vast number and variety of the minute cryptogamous forms of life to be met with in all articles of food, particularly the fruits, nuts and roots. In the sweet potato I find forms developing before decay, resembling B (which is an enlargement of one of the forms found in the cavity in Fig. 1). They are dark but covered with spines more or less permeable by light, and having a length as to width of six or more to one. They appear before the mycelium of a well-known pencillium, and resemble it in no respect, and I trace no connection between the two, except that the spiny form seems always to precede the mycelium of this pencillium.

This mycelium is hyaline, smooth, of indefinite length, with many fine branches, and seldom exceeds the tenth of a milli-

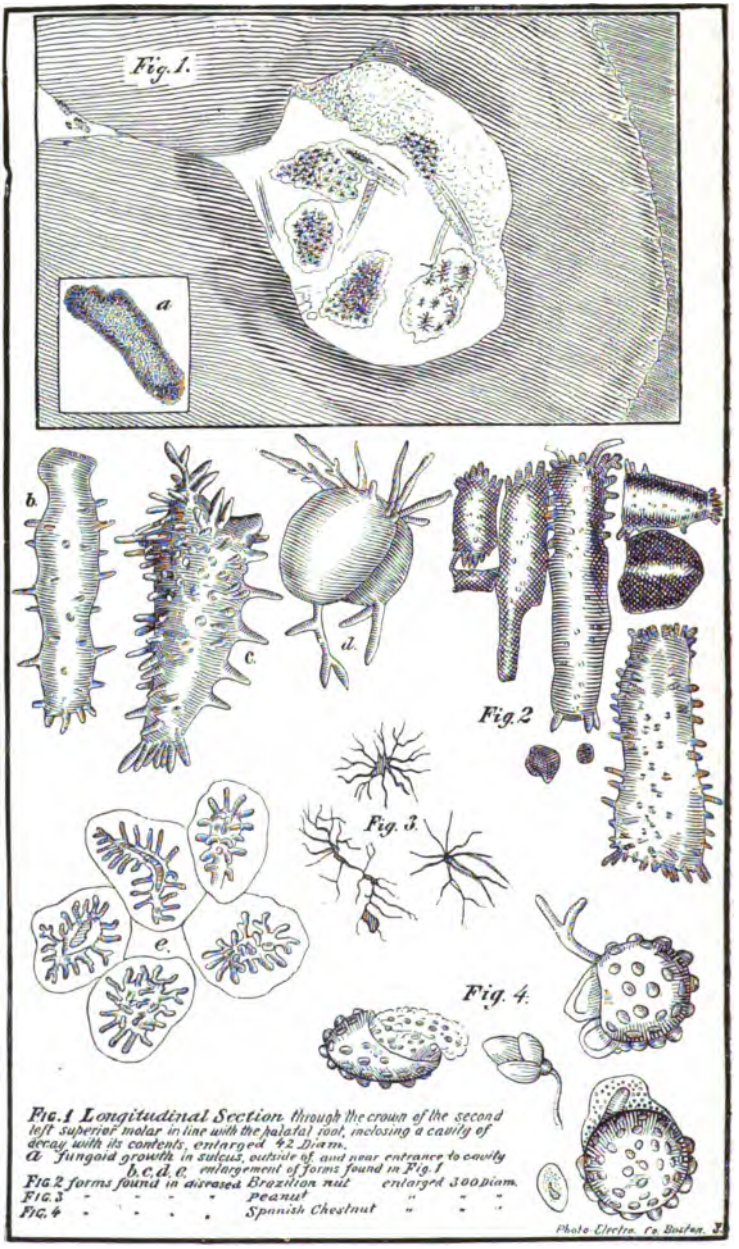


Fig. 1.
a
b.
c.
d.
Fig. 2
Fig. 3.
e.
Fig. 4.
Fig. 1 Longitudinal Section through the crown of the second left superior molar in line with the palatal foal, inclosing a cavity of decay with its contents, enlarged 42 Diam.
a fungoid growth in sulcus, outside of, and near entrance to cavity
b.c.d.e. enlargement of forms found in Fig. 1
Fig. 2 forms found in diseased Brazilian nut enlarged 300 Diam.
Fig. 3 " " " " Peanut " " "
Fig. 4 " " " " Spanish Chestnut " " "
Photo Electro. Co. Boston.

meter in size. In growing, their course is between the cell-walls of the starch-grains, thus causing an old wilted potato to stiffen up and appear quite fresh. As they progress, sporidia-bearing filaments penetrate the starch-cells, changing their contents to carbonic acid, water and sporidia. Then, by the rupturing of the starch-cells, the potato suddenly becomes soft and is soon covered by white spore-bearing filaments, in which condition it presents the appearance of the body found in the sulcus in Fig. 1, marked A, enormously magnified, an enlarged view of which is given in the white square on the enamel. It will be seen that the potato may be considered good food, whilst largely composed of fungoid forms, mycelium and sporidia. When the potato is cooked,— more especially when baked,— the part infested by the fungi will be found harder and darker than the other parts, and also to give off a peculiarly disagreeable odor. Heat, sufficient to cook the potato, seems to destroy the vitality of the fungi, so that when thus eaten, they do not seem to disturb the digestion.

What I have said of these forms of fungi in the apparently healthy potato, M. C. Cook, in his "Rust, Smut, Mildew and Mould," has said of many other articles of food which I have been in the habit of eating (as the sweet potato) uncooked. Apples, pears and peaches have — in addition to the forms alluded to above which grow within — other forms growing upon their surface, allied to lichens. In the beet, turnip and onion, whilst in an anticarious condition, fungoid forms were discovered resembling some of those found in this cavity, but which are not here illustrated. The castana or Brazil nut showed a large variety of fungi. In one of these, microscopic truffles, or bodies resembling the truffle, were found packed solidly throughout the entire mass. When placed in water, a hyaline mycelium was developed, giving them when magnified the appearance of D, in the plate.

Fungi were also found in this nut having red mycelium, others with yellow mycelium, and others still with white mycelium. Some nuts were examined in which the meat had been changed, apparently by fungi, to palmic acid. Other crystalline forms were present that gave under polarized light a varied and most beautiful appearance, such as feathers, fleecy clouds, tropical palms, and the frost-work upon the window-panes,— all most brilliantly rainbow-tinted. One portion of this nut, mounted for the microscope, gave,

when magnified three hundred diameters, the forms seen in Fig. 2, which are not unlike in appearance B and C,— the latter being enlargements of forms observed in the cavity of decay in Fig. 1. The mites which infested many of these nuts were destroyed in large numbers, at a tender age, by a red spore fungus which had a yellow mycelium. I found red sporidia of this fungus both in eggs, and young mites in the sacculated stage. The adult mites seemed free from them. The full-sized sporidia were as large as human blood-disks, and seemed filled with minute spores not more than the fifteenth of their diameter.

The Pecan nuts examined had, with but few exceptions,— and in these the meat was bitter,— the mesocarp packed solid with the spores of a red fungus containing a very large percentage of tannic acid. From less than a pint of the shells I obtained over two ounces of tannic acid of a bright ruby color. The mycelium of this fungus in its development in an open vessel, when kept at a temperature of 98° Fahrenheit, gave off fumes of acetic acid, and upon the addition of a small amount of aqua-ammonia the fumes were rendered exceedingly pungent, resembling those of nitric acid. In some of these nuts the red fungus was absent, but another was present with forms exactly like those in Fig. 3, which were found in the peanut. All the same forms were also found in the little red checkerberry, *Gaultheria procumbens.*

All of the single forms infested by fungi had this ray-like appearance. The English filbert exhibited three forms of fungi growing within it,— one constantly present growing within the substance of the cotyledons, the mycelium of which was so minute as not to be traceable in a microscopic section, but when sown in a tumbler of water it developed with great rapidity and formed a net-work throughout, giving it an opalescent appearance. In a short time a dense film formed upon the surface, which gave off a highly offensive odor. It was whilst experimenting with this fungus that I was six times prostrated by typhoid fever, or a fever resembling typhoid, which yielded quite readily at first to an abortive treatment, consisting of an internal exhibition of bisulphite of soda and carbolic acid combined. Subsequent effects, however, compelled me to give up the further study of this fungus.

The other fungi developing between the pericarp of the cotyledons merit a passing notice. One of them resembled minute

cocoons of a lepidopterous insect, being minute globes composed of yellow mycelium and containing within red spores. The other showed red mycelium with long club-shaped spore heads with spores growing in sulci upon it. All the spores in this nut were very much smaller than those found in the Brazil or the pecan nut. The forms illustrated on the plate at Fig. 4 were found in the Spanish chestnut, and exhibit the minuteness of the spores, and also show their gradual development as well as the commencement of the growth of mycelium. One body, centrally situated, shows the development of spores by gemmation. Other forms show the development of spores by septation. The spores in two cases are seen escaping from the sporidia.

M. C. Cook, in his account of the British fungi, says that the cryptogamous, unlike the phanerogamous plants, give off carbonic acid and absorb oxygen. We generally recognize such to be the case with some of the ferments, while others give off acetic acid, as was the case with the fungus found in the pecan nut, and as also is the case with the "mother" which grows upon the surface of cider when exposed to the air. There are facts which seem to show *that the only limit to the acid products of these bodies,— the fungi,— is the constitution and condition of the substance in which they find lodgment and are capable of developing*. The vast number of these bodies may be inferred when it is known that mycologists at the present time, with a liberal allowance for hair-splitting, reckon among British species of flowering plants only one-fourth of the number of the fungi alone, not to mention ferns, mosses, algæ and lichens. There are strong reasons for believing that carbonic oxide is also developed by some of these low forms of vegetable life. Would it not be proper to call them vegetable deaths? It is not clear to my mind that any of these, if left, would multiply for any length of time at the expense of the tooth, but it is perfectly clear that many of them have been introduced with particles of food, where by their presence they have exerted an injurious effect upon the tooth substance, in that they have acted to decompose the food with which they were associated, if not also to decompose portions of the tooth.

It is well known that in all fermentable substances, fermentation is started by the presence of an azotized body; that the fermentable substance changes and has formed within it, as a result of this

fermentation, some acid; that fermentative changes take place with varying rapidity, according to the more or less favorable conditions of temperature and moisture; that the buccal cavity is, in a normal condition, most highly favorable to such changes; that all foods are more or less infested by some form of fungus; that the air is, to a great extent, at the sea-level, and over most of the earth's surface, so impregnated with cryptogamous spores (and all cryptogamous spores are nitrogenous); that foods can only be kept from fermentation for any length of time by destroying the azotized bodies with which they are in contact, by the application of a temperature sufficiently high to destroy all such life, or by combining with them certain chemical agents. It is also well known that all foods not so protected against contact with azotized bodies will, in the presence of sufficient warmth and moisture, be liable to destructive fermentation. Hence it may be seen that wherever there are imperfections in teeth, or places where a lodgment of food or fermentable matter may occur, there will be liability to the formation of acids, and of course to the solution of lime-salts in the contiguous portion of the tooth. So that all imperfections that cannot be so filled as to perfectly secure them from further lodgments should be so shaped as to readily be kept clean by friction. Teeth with soft enamel will naturally be the most difficult to preserve by filling, as in such teeth the crystals of enamel are more loosely put together, the spaces between them more easily penetrated by foreign substances; and a greater difficulty will be found in coapting the filling, of whatever nature, to the surfaces of such teeth than to the surfaces of the more dense and perfect. And it will be understood that the softer and more pliable the filling material, the more readily will it pass into the inequalities of the surface, and hence more perfectly protect it. But it happens, most unfortunately, that of the substances used for such filling purposes, the one most stable is the most difficult to adapt perfectly to the minute inequalities of the walls of a cavity.

With these facts in view, it is not necessary to consider gold as "incompatible with tooth-substance" in order to account for the failures which in certain cases have been attributed to it. But this difficulty attending the adaptation of gold to the walls of the cavity is easily overcome, for nature has not left us without a fitting substance to fill these minute scratches and imperfections of soft

teeth, to the entire exclusion of the minute spores we have had under discussion. This substance will no more sustain the life of a fungoid spore than will carbonic monoxyde the life of a human being. It is pliant, inodorous, tasteless, non-oxydizable, non-volatile, non-irritant even to the pulps of teeth, by which it is readily absorbed, inducing in them the highest functional activity compatible with comfort to the individual. This substance is vaseline.* With the aid of vaseline the dentist will now be enabled to save the soft teeth as readily with gold as he formerly did those of a denser structure.

My method of using this material is as follows:

After having prepared the cavity for filling by the removal of débris and carious walls, and by properly shaping it, I destroy the low forms of life in the walls of the cavity, so far as I am able, by the use of a saturated aqueous solution of carbolic acid and a saturated aqueous solution of bisulphite of soda, singly or combined. I then dry the cavity with bibulous paper, and with a small wad of the same rub into its surface the vaseline, leaving a superabundance in the cavity until I am ready to fill. I then wipe the cavity clean, just as the steel and copper-plate printers do the face of the plate when about to print from it. And just as the ink is retained in the lines and scratches of his plate, so will the vaseline be in the porous enamel and scratches in the dentine, to the exclusion of other foreign matter.

DISCUSSION.

Dr. SPALDING: The conclusions to which Dr. Black in his paper has arrived are particularly grateful to me, for the reason that they coincide with my own previously formed views on the subject. The investigations and observations of the author confirm my theoretical views. It is a subject which is of great practical importance,— one which has been largely studied before, but, so far as I know, there has never been any positive illustration of it that compares with what we have had this morning.

* Vaseline is one of the products obtained from petroleum by repeated filtration through boneblack, according to a process patented by Robert A. Chesebrough, and furnished by him to the profession, without a royalty.

I consider it one of the most valuable papers we have had, settling, in my mind, many disputed questions, especially that with regard to the lateral proliferation of the odontoblasts. It shows the process by which dentine is originally formed, and by which it is subsequently formed as age progresses and the capacity of the pulp is diminished. Light is also thrown on the subject of the formation of what we call secondary dentine.

Dr. BUCKINGHAM: I want to say something on the subject of Dr. Black's paper upon Dentine. From examining authorities, carefully comparing one with another, I have come to certain conclusions with regard to the production of dentine that I wish to present to the Association, and these are different from some views already advanced. I intend, in the discussion, to jump from one point to another as rapidly as I can, but I want to get a firm foundation to start from.

The first formation of organized tissue is the cell. One would suppose that this has been admitted so long that there would have been some definite idea of its form and nature, but, unfortunately, you will find that the views of different authors in regard to what constitutes cells and their functions are as various as the authors who write upon the subject. I do not wish to examine and compare the different views, but we must have some starting-point if we wish to understand each other. Virchow describes a cell to be a sac filled with fluid; Beale describes it as a mass of germinal matter, which afterward becomes hardened on the outside. This process of hardening gradually goes on until the germinal matter occupies but a small part of the cell. The hardened portion he calls formed material, which has lost the power of reproduction, but retains the functions of living matter. These cells are the basis of all organized tissue. Examine an organ where you will, you will find it is composed of cells. The smallest form of animal or vegetable life is a simple cell,— the monad, a simple sac filled with a fluid. It has the power of digesting its food without a stomach; to discharge it without a vent. It moves without muscles, feels without nerves, performs all the functions of life, and has the power of producing "*cells similar to itself*." In regard to size, Beale has measured cells down to the one hundred thousandth of an inch, and others have been described as large as the one hundred and twentieth of an inch. Take them at their largest

you will find them extremely small, yet it is in these little workshops that nature produces material to build up all organized tissue, just as in the inorganic world she is working with atoms to build up mountains.

Cells multiply in different ways. Some have one or more nuclei, which go to form other cells; some multiply by budding, and others by segmentation. Beale thinks that the smallest portion of this germinal matter may separate and form cells, but both Virchow and Beale state that a cell must come from a parent cell. Cells sometimes multiply with great rapidity. In some vegetables they will produce almost millions in a short time. At this point I want particularly to state that I understand Beale to divide cells into two parts: "the formed material and the germinal matter." The germinal matter alone has the power of producing new cells. The formed material has the functions and action of life, but not of creating a new cell. At first the cell is all germinal matter, and after a time it becomes hardened on the outside. This hardening process continues until the germinal matter, in many cases, occupies but a limited space. The germinal matter gives life, and the formed material gives form. I don't want to elaborate further on this point, but I want to state that cells produce cells similar to themselves, and yet, where there is a necessity for a new organ, there appears to be a special cell created for the purpose, and afterward it multiplies until the organ is produced. I do not know that there is any case in which one tissue will produce cells to build up another tissue different from itself. The old theory was that plasma was thrown out, granules formed in the plasma, and these formed cells, so that there was a spontaneous generation.

We are told in the books that the enamel is produced from the enamel-organ, and the dentine from the pulp. Would it not be more rational to suppose that, when one enamel-cell was formed, it would have the power of forming others, and so likewise with the dentine, and not create a special organ for the purpose of producing a tissue dissimilar to itself? The theory of the elder Tomes was, if I understand it correctly, that there was first a papilla, then a dental groove. The papilla is composed of nucleated cells. After a time the papilla is surrounded by a follicle, which eventually becomes a sac and incloses the papilla. The inner portion of this sac separates from the papilla, or pulp, as it

is now called, and the intervening space is filled with a soft, gelatinous mass, in which the enamel is formed,—the pulp being the part which produces the dentine. This production takes place by the development of cells, which arrange themselves so as to form tubes. The description given of the development in the more recent works is that there is an inflection downward of the epithelium, forming first an open sac. This becomes the enamel-organ, and in it the enamel-cells are formed. These cells arrange themselves in a columnar form, and so form the enamel-rods, each rod being composed of a number of rods joined together. Beneath this enamel-organ the dentine is formed by the dentinal pulp becoming converted into dentine. To this point I take exceptions. I think it would be more rational to suppose that after the first dentine cell is formed, it becomes the parent of the others. I would have it that these arranged themselves to form the outer layer of the dentine, and, following the process described by Beale, of becoming hardened on the outside, the germinal matter is continually pushed toward the pulp, leaving behind, in fully formed dentine, a mere fiber. By this theory we can understand how one cell can form the whole tube and a series growing together would form the dentine. These cells having, in their downward growth, to occupy a continually diminishing space, may and do unite, and thus form the branching of the tubes. I do not believe that these cells, or odontoblasts, as they are called, are part of the pulp, or that they are even formed by the pulp, but they grow from a parent cell or odontoblast developed by some process not understood. If this theory is correct, the pulp cavity is lined by a series of these dental germs or cells, which grow inward toward the pulp until the tooth is fully developed, leaving behind them a fiber of germinal matter. The outer portion of these cells hardens and becomes the dentinal cartilage, in which the lime salts are deposited. These cells always exist in a living tooth after full development has been obtained, but their growth is arrested by some process of nature, and remains stationary unless excited by reason of some irritation, when a second growth takes place, forming what is known as secondary dentine. I do not think that the pulp has anything to do in its formation further than to carry pabulum to the cells.

Dr. ATKINSON: The writings on this subject in the text-books that have been published to the world, and are more than ten years

old, you are wasting your time and energies to deal with at all. Men who have been the workmen in this direction have in the main worked separately. We have an eminent example of this in the beloved brother from Illinois, who shows conclusively that he has been working earnestly, but he has been crippled by the abominable heresies of false doctrine that he has found in the books, and, thank God, he has kicked against it, though he has got somewhat entangled in it. Professor Spalding said the report of Dr. Black nailed the growth of the dentine clearly, and proved that the steps he took were sound. His specimen did not prove that there was no presence of odontoblasts, and that there was a successive generation of them. There were many suggestions and dogmatic statements in the report that would consume more than the time allotted me to consider in detail.

I shall not refer you to incorrect diagrams and badly manipulated specimens. We are easily befogged by such means. Any other diagram than one which is true to the fact in nature I hold to be a subterfuge. A good deal has been said in the various papers with regard to "epithelium" and odontoblasts. As you love the truth, don't say "cell" again, not even after the description given by the last speaker. Cells are vegetable products. There is not a cell in the human body, only so far as they are vegetative in their nature. Crystals belong to the mineral kingdom; colloid bodies, or corpuscles, belong to the animal kingdom; and in the definition of a "cell" that you heard a few minutes ago, the ordinary description of an "amœba" was presented to you; which is the first form of animal existence, and is represented in this diagram as a colloid body heretofore supposed to be without differentiation; but that theory has been exploded by Carl Heitzmann.

[The speaker here explains a cut or diagram representing the differentiation of the body referred to, and also refers to other diagrams, which description cannot intelligently be reproduced.—REPORTER.]

Dr. McQUILLEN: The subject of Histology, as far as my own brain is concerned, is a little mixed, for we have had so many papers, on such diverse subjects, that it is a little difficult to know what to take up. We were informed this morning, by my friend Dr. Atkinson, that some very startling discoveries had been made

by a gentleman in New York. I do not wish to question that he may have made some discoveries, but I cannot, after listening to the reading of the paper, recognize the wonderful nature of the discoveries which we were promised. My friend will agree with me as a microscopist, that when a paper is presented before a microscopical society, we should demand not diagrams but specimens. We want to see for ourselves. Diagrams will not answer. I am glad to know that the gentleman is at work with the microscope. If he has not discovered, he may be on the road to a discovery; but I want to say in regard to that modest man from Jacksonville, Illinois,—Dr. Black,—that he has been making some very excellent specimens; and he showed us specimens at Chicago, last year, some of which are now under the microscopes on the table, that reveal structure claimed as new and original discoveries in the paper read, if I understand it aright. In making investigations, a man comes across something he thinks is original, which, on examining the literature, he finds had been discovered and presented to the world long before. In the experiment, described to you last evening, on the pigeon, I thought I had been the first to keep a bird alive, after the removal of the cerebrum, for a month; but on examination found that some one had preceded me in that matter. In original investigation it is important one should be thoroughly familiar with the literature, in order that he may not claim as new that which has been already placed on record.

Dr. Black: The time of this Association is so fully taken up, and we have so much work yet to do, that I have hesitated to say anything more upon this subject, but having been called upon, I will say a few words. I did, some years ago, prepare some specimens, practically in the way referred to in Dr. Bödecker's paper, that seemed to me to show those things, or a large portion of them, that have been mentioned. I had no special thought that this was a new thing. I do not know that I thought of it in that manner particularly; but one thing I did think about it,—that it showed a good many things that we have not been able to see by the ordinary modes of preparing specimens; consequently I was very glad, when this subject came up in the form that it did, to hear the expressions of others in regard to it, and their experience. But there is another feature in this paper, entirely different, perhaps, from this, which does not necessarily hinge, as I think, upon the

mode of preparing a section, and that is, the engrafting of Carl Heitzmann's protoplasmic-string theory into our conceptions of the histological structure of the hard tissues,— the dentine, enamel and cementum. Well, something of this kind may be seen there, but this is certainly a theory that we should be a little slow to adopt. If there be anything new in the paper, it is this point. I do not know that there is anything else that I saw in the drawing that is particularly new—that I have not seen; and I suppose other microscopists have seen the same. Others have prepared sections practically in the manner described in the paper, besides myself, although the author may have known nothing about it, but I did not suppose it was new. I want to speak of one thing in regard to the enamel-organ, that others may notice it, that some understanding may possibly come from it in the future. It seems to bear the same relation to the developing tooth that the white of the egg does to the chick,—being a store of material for the building. Take the enamel-organ of a developing tooth, say at five months, drop it into gum arabic for fourteen hours, place that in alcohol, and after a few days draw it out and cut it into sections, and you will have the whole enamel-organ in its perfection,—precisely in position and but little shrunken. Take the same thing, drop it into a very mild solution of acid, and then carry it through the same process, and there will be no enamel-organ there.

The removal by the acid of the lime salts stored for the building of the enamel has so changed the osmotic properties of the contents of the organ, that all has been removed and the organ collapsed.

One word as to the epithelial cord of the permanent teeth. We have been taught that it arises from the cord of the temporary tooth. While this is generally true, it does not seem necessarily so, for I have observed that it sometimes arises directly from the epithelial lamina. I have in my collection a number of sections which show both the cords of the temporary and permanent tooth, —each proceeding separately from the epithelial lamina to their respective germs. The facts seem to be that the cord for the permanent germ may arise from any point on the cord of the temporary germ, or directly from the epithelial lamina, there being no absolute rule.

Dr. DEAN: I have seen some specimens of Dr. Black's, in which

it certainly seems that the cord of the permanent follicle comes from the epithelial lamina of the mucous membrane; but the theory of Tomes, Kölliker, Magitot and Frey is, that it comes directly from the epithelial cord of the temporary teeth,—that is, for the twenty permanent teeth.

Magitot believes that in all cases the cord of the permanent teeth,—excepting the first molar, which emanates from the epithelial lamina, the same as the temporary teeth,—he believes in every case they start out from this epithelial cord, and as the sac (or the follicular wall, as he calls it,) rises above and incloses the bulb and enamel-organ, it cuts off this cord; so that in all cases, if you examine the fœtus about the sixteenth week, after the epithelial cord of the temporary tooth is thus severed, the enamel-organ of the permanent tooth, which in reality originated from the cord just severed, will have the appearance of originating directly from the epithelial lamina; although he states that it does not start from any particular point upon this epithelial cord of the temporary follicle. He has figures, however, which would indicate, to my mind, that sometimes the cord arises directly from the follicular sac.

For the first permanent molar the epithelial cord arises from the epithelial lamina, in the same way that the cord of the temporary tooth does; and when you come to the second molar, this arises from the cord of the first molar, and the third molar arises from the cord of the second molar. That is his idea of that matter.

Dr. ATKINSON: There has been so much misapprehension of the use of terms, that it would be in vain for me to try to straighten the matter out. There has been seemingly a sort of feeling that there could be a reason in any man's mind to make a statement that did not seem to be true to him. I want to say that, of all the men I have ever met in my life, histological students are the pink of perfection for honesty in stating what they see, and they are the most willing class of men to rectify any misapprehension that I have ever met. They are simply dogmatic when they have studied alone, and have not had pupils enough to correct their apprehensions. If a man feels that he knows his subject so as to be beyond error, all he has to do is to get a class of pupils that will witness the same experiments that he does, and they will very soon

enable him to rectify any mistake. As to the question with reference to what I said was in Dr. Bödecker's paper, either the gentleman meant to call me out to explain more fully, or he was so inattentive that he paid no heed to what was in the paper. I stated that it was but the synopsis of one that was preparing upon that subject, and that it will recite all the authorities from the earliest time until this present day, and in that recapitulation make a statement of the failure to have found anywhere the interpretation given by Heitzmann in the first place, and by Bödecker in the second place; and all that I claimed to be new was the discovery in the enamel of what has been called "Max Schultze's Thorns,"—that is to say, protoplasmic strings in the enamel of a lady's tooth, who was forty-five years old, shown without any decalcification at all (ground down while in a perfectly natural state, and as soon as possible after it was taken out of the mouth), and from which these drawings were made, that are correct and faithful representations of veritable objects.

What is new to-day? That all the tissues are connected by protoplasmic strings; and Carl Heitzmann was the first man who pronounced that, as far as I am aware.

How do amœba move? We have been told all the way through that an "indifferent substance" was enabled to project the movement of all the animal bodies; that is to say, that they were able to perform all the functions of body without a single organ. That, Carl Heitzmann has set to rest, for he has shown us that the manner by which an amœba does move is to throw out, by the elongation of protoplasmic strings, a portion of its jelly-like body, and make what they call "pseudo-poda," the portion by which it seizes upon the slide or cover, and thereby, by the process of suction, make fast to that, as we boys used to lift a brick with a wet leather disk.

I do not claim that the idea of the interglobular masses being connected with the dentinal fibrils is new. I have known of it since I have known microscopy at all. What is new in this direction? Principally Carl Heitzmann's discrimination and interpretation of protoplasmic granules and strings, which he demonstrates with a power of from five hundred to one thousand linear. It is not that teeth are not produced to-day as they were formerly, but that we are more earnest seekers for truth.

How many kinds of amœba are there? One authority recognizes six distinct kinds. What is the first kind? It is a non-nucleated amœba — a lump of jelly that is so small that it requires great patience and much skill, with very high powers, to discover the protoplasmic strings in its body at all, and there is no other differentiation in it. Then we have the nucleated amœba, with one nucleus, and then two, and three and four, and after four they are called polynucleated. I should be glad to go through the books and show what is old and what is new, but we can wait.

Dr. McQuillen: My friend says the microscopist sees before him what is offered to his eyes. That is true, but in investigations in any department of science, men start out frequently with preconceived theories, and that which they see before them they very often interpret in favor of that theory. Men starting with preconceived opinions often see only the things that corroborate them, and overlook or ignore facts that would oppose the hypothesis. There are two methods pursued in science: one of reasoning inductively from cause to effect; the other deductively, or looking for the facts to corroborate an hypothesis. Scientific men generally pursue the former as the safest course. The adoption of both methods, in some instances, is invaluable, the one confirming the other. As has been said, it may be that Heitzmann's theory is projected into this paper; on this point, however, until I have an opportunity of carefully reading the paper and examining the specimens, I do not wish to express a positive opinion.

There is no reason why we should be confined to the authority of books. Owen, Kölliker and Tomes are valuable in showing what has been done, and are entitled to respect as authority; but we should not be content to see with their eyes alone. Every person in the Association has a pair of eyes and a brain, and should learn to use them in examining the page of nature and reading the truths there presented. The expense of a microscope may be urged as an objection. A serviceable and effective instrument, made by Zentmayer for about sixty dollars, has been shown to you to-day; it would answer your purpose to begin with. The one thousand and fifteen hundred dollar microscopes are too often but costly toys to their possessors.

REPORT OF COMMITTEE

ON

PATHOLOGY.

By W. H. ATKINSON, Chairman.

PATHOLOGY is conceded by all to consist of arrest or deflection of physiological or harmonial functional movement.

It will be in vain to pursue this subject without some statement of the activities, a derangement of which constitutes the mode of function denominated pathological.

Physiology is generally defined to be the nutrient operations of the body as a whole, and of the organs as special manifestations of function. Neither of these, however, is capable of revealing to us the changes that constitute the production and maintenance of these factors of nutrient activity. Systemic and organic activities are but mass presentments of function as aggregates of tissual and molecular changes — occult, indispensable prerequisites to these commonly recognized examples of function.

Molecular changes depend upon the engagement and disengagement of bonds of energy belonging to atoms of which the molecules are composed. The production of water, for instance, depends upon the mergence of two gases into one fluid, by the engagement of definite measures of energy, symbolized by the type of a molecule of water (H^2O) in chemical nomenclature. Any other combination of hydrogen and oxygen would present us with a different molecular body. Again, combustion of vegetable and animal substances will always produce water as one of the resultants of the change of molecular relation.

Physiology may now be more accurately defined to consist of REGULATED COMBUSTION OF PABULUM, UNDER THE GUIDANCE OF TYPAL DEMAND, and pathology as a *conflagration of pabulum*, UN-

DER THE CONTROL OF THE FORM OF MOLECULAR AFFINITIES DENOMINATED CHEMICAL. This last has long been recognized as the process of INFLAMMATION, to which we will now direct our attention.

The gradual growth to higher and better interpretations of the phenomena of inflammation, as displayed in the works of John Hunter, Virchow, Rèmak, Billroth, C. O. Weber, Von Recklinghausen, Conheim and Stricker, not to mention many others, are proofs of the want of complete satisfaction with which each has looked upon the labors of his predecessors and co-workers, as well as upon his own efforts.

Till this day it is impossible for the best observers to designate the point at which *physiological* activity becomes *pathological*. It is at least an entertainable proposition that some of the normal operations attendant upon the ripening of ova and spermatozoids are properly classifiable as inflammatory activities.

Histological research has shown the "corpus luteum" to be composed of scar tissue, of a like character with scars resulting from traumatic and inflammatory lesions. Excess of blood-plasm in any locality is liable to be converted into embryonal corpuscles, or mucous globules, as the indifferent basis from which normal and abnormal products arise, according as the environment tends to lead to one or the other. Simple hyper-plasia tends to increase of the normal tissues. When the blood-tracts are obstructed, and the press of the currents great, stasis, exudation and retrogressive molecular changes take charge of the exuded blood-plasm, and convert it into the products of the inflammatory process, which this retrogressive metamorphosis constitutes.

Late histological discoveries strongly indicate that *nerve-currents* and *blood-currents* are necessary conditions to allow inflammation of any territory. Those territories, therefore, that are not supplied with blood-circulation and nerve-currents are, if unaided, incapable of repairing their wounds when traumatically induced. When the neural and vascular currents are coetaneous and unobstructed, it is doubtful if any mere acceleration could result in the inflammatory process; but when the heart's action is too great to exactly balance the tonicity of the capillaries supplied by the nerve-currents, obstructions are readily induced in the tortuous channels of the capillary system.

To prevent the inevitable advent of inflammation under such circumstances, the obstructions must be removed, and the simultaneousness of nerve-currents and blood-currents be regained. The simplest method of accomplishing this desirable end will be to call the part into vigorous exercise by voluntary or involuntary effort of the subject, or by "massage," the manipulation of another person. The only reason why all inflammations might not thus be successfully treated depends upon our inability to cognize the departure from health at this early stage and to get at the locality.

Swelling, redness, heat and pain have universally been grouped together as the definition of the inflammatory process. No one has put on record even an approach to a legitimate, clear and satisfactory statement of the precise difference between normal nutrient function and its derangement, called inflammation.

Let us examine the process of conversion of pabulum (protoplasm) into the elements of tissue, and learn, if we may, that pleasure and pain, health and disease, are qualities or modes, and quantities or measures of functional activities, that vanish into each other by disturbing and restoring the balances of regular molecular changes. To comprehend these we must cognize the existence of atoms, of which the molecules are composed; and to understand the manner of the coming together of the atoms to construct the molecule, we must take into consideration the static and dynamic aspects of the atoms, no less than the awakening and engagement of the definite measures of energy that effect the combinations. Why and how the molecules move are the two questions the correct replies to which shall reveal to us the complete explanation of all functional movements, and declare how they are produced and maintained or destroyed, in functioning bodies.

Pain is the result of obstructed sensory nerve-current; *swelling* supervenes upon obstructed vascular current; *heat* is resultant upon obstructions in the neural and vascular channels, by which the mechanical movements of the masses of nerve-blood and vascular blood (through impact against the points of obstruction) become changed into molecular movement, which we then cognize as *heat*. These three, namely, pain, swelling and heat, *are the only essential factors* or necessary concomitants in the process of inflammation. The redness that has heretofore been made an equal factor is a mere incident, as is proved by the fact that some swellings are white.

What, in the next place, are we to understand by quality or mode, and quantity or measure of function? And how are we to differentiate these predominant aspects of the complex presence we nominate function of mind and function of body? The function of mind consists of seriated arrestations and releases of the tensions of consciousness or of the power of perception. The functions of body are also seriated successions of arrest and release of tensions of molecular and atomic bodies, through which the energy operates to produce molecular, granular, corpuscular, tissual, organic and systemic forms of function in their various manifestations.

Late works on chemistry assert that heat is given out or produced by combinations of atoms, and is taken up or quenched by separations of atoms. Works on physics tell us that "heat is a mode of motion," and that mechanical motion upon being arrested is converted into molecular motion, which is heat." How, then, are we to account for the heat set free upon the admixture of sulphuric acid and water? How does the friction produce the heat so largely by the mere rushing of the molecules of water among the molecules of acid?

The partially engaged, unsatisfied or sleeping bonds of affinity belonging to the atoms in the molecules of water and acid are in a state to be easily aroused into active motion, by any impact of current within the sphere of influence, be it direct or oblique, simple or manifold, in its advent. We understand the diffusion of water-molecules and acid-molecules to result from the desire to attain equidistance from each other in the mass of fluid; and the rush to acquire that tension effects the awakening of the sleeping bonds of energy, which, being set in motion, manifest the intense measure of heat always attending this experiment.

The difference between this process of disengagement of heat and that form attendant upon the inflammatory process in animal bodies, consists in the greater complications of engagements and disengagements of bonds of affinity in the molecular mass in which these changes occur; and the greater freedom of the fluid in the vessel of the chemist, as compared to the confinement of molecular mass in the tissual interspaces of animal organisms. There is also a larger number of elements entering into the molecular mass, which is the basis of all animal forms of metamorpho-

sis, than in the mass composing the vegetable or mineral examples of molecular aggregations. Hence the increased opportunity for the display of greater varieties of molecular changes that split up and minify the thermal and other currents possible to this limited territory.

There is such a thing as having the receptacle of molecular mass so packed with molecules as to preclude any motion among them. This has been proven by the stoppage of fermentative action by the pressure of a given number of atmospheres. Take the example of a fermentable substance placed in an air-tight transparent vessel; exhaust the air by the air-pump, and then inject pure oxygen into the receptacle containing a quantity of yeast taken from the tub, fresh and active. At first, bubbles of carbon-dioxide (carbonic acid gas) will break and rapidly disperse into the vacuum above the yeast, and there being no free oxygen present to support the fermentation, molecular change ceases to appear. Now admit pure oxygen in a small quantity, and the fermentation is again set up with increasing activity, in the ratio of the quantity of oxygen supplied up to a given measure. So soon as the tension or pressure of the incoming current of oxygen shall interfere with the freedom of the oxygen molecules in the space above the yeast, the activity of the fermentative change gradually lessens and finally ceases altogether. When the compression of the oxygen is great enough to arrest the motion of the oxygen molecules, they assume a static condition, preventing further changes between the oxygen and the hydro-carbons of the yeast. The yeast in the vessel is now in the condition of a "pop-bottle," or a bottle of "mineral water," fully charged with carbon-dioxide. All that is requisite to reëstablish the fermentative activity is to take off the pressure from the gas above the yeast in the vessel by giving it vent, so that the molecules of oxygen may be free to move among each other again, and then the attraction between the oxygen and the carbo-hydrates of the yeast-mass is at once set vigorously at work generating molecules of alcohol and carbon-dioxide out of the already existing albumen, glucose or diastase in it.

The alternate combination and separation of atoms, to construct the varieties of molecules in the mineral, vegetable and animal primates of bodies, is repeated and amplified, magnified

and minified, by the necessities of *the types of the individual presence*, in the various crystals, cells and corpuscles that are the characteristics of the three kingdoms known to exist as planetary presentments. A serial order of appearance and disappearance (or coming from without and passing beyond the range of our sensuous perception) pertains to the origination, growth and decline of every example of individual body or class of bodies, be they mineral, vegetable or animal. The chaotification of these gives the foundation from which all human functional capabilities originate; so, to understand all the activities possible to human bodies, we must become acquainted with the activities of the whole universe, of which man is the epitome.

"The whole is equal to all its parts,"—is an aphorism in the study of inflammation as true as it is in mathematics, astronomy and physics. The combustion of hydrogen and carbon with oxygen is well known to produce *heat*. Friction also produces heat to the degree of ignition of combustible substances. Are we not then justified in assuming that the heat of fever and inflammation is also the product of combustion? Does not this indicate that whatever prevents or arrests combustion will also arrest fever and the inflammation upon which it depends? The difference between fever and abscess is the difference between the combustion in a charcoal pit and in an open fire. The first extracts the hydrogen from the combustible substance and leaves the particles of carbon in their undisturbed position in the charcoal or the coke; the second oxidizes the carbon and hydrogen, converting them into carbon-dioxide and water,—both of which conspire to change the mineral constituents of the wood or coal into the salts of which their ashes are composed.

If we desire to understand just what fever and inflammation are, we must comprehend the process of combustion. Combustion is the undoing of the work of the sun, which constructs mineral, vegetable and animal tissues. How does this occur? Simply by the influx of an energy that enables the oxygen to disrupt the bonds of affinity, which "clamp" the atoms in the molecules, and the formation of other molecules by the use of these "clamps" in a different order of engagement of bonds. . . . Multivalent atoms are those which have many bonds engaged. We may conceive that these are placed in the "center," or "skeleton," or "nucleus,"

of the molecule, around which the atoms, having few (two or three) bonds engaged, are distributed in a variety of ways. This variation of the "skeleton" and "flesh" of the molecule is the measure of the differentiation among proximate principles. Slow oxidation of moist organic substances, especially those containing nitrogen, gradually consumes without sensible elevation of temperature. This has been called "eremacausis" (or burning by slow degrees). Fermentation and putrefaction are both examples of oxidation also, but with sensible elevation of temperature. Fermentation is distinguished by giving off no offensive gases, and by producing useful compounds; putrefaction is characterized by the exhalation of offensive and deleterious gases. . . .

By this play of affinities, under the direction of the demands of the types of all forms of molecules composing human protoplasm, we have the elaboration of all the proximate principles belonging to the tissues of the human body, embryonal and adult, of a healthy or diseased character. Just how it is that the changes of position of molecules effect difference in the proximate principles,— protagon, neurine, myeline, mucine, olein, margarin, cholestrine, cerebrinlecithin, and a host of others (isolable, real and hypothetical bodies, nevertheless veritable radicals of the deciduous and permanent tissues of the body),— is not just yet demonstrable without great labor with expensive apparatus.

But we do know, and can demonstrate, that tensile strength belongs to fluids as well as solids (if not to gases also). Bubbles on pure water prove the tensile strength of H^2O to be a fact, which is more easily displayed by adding soap, or other viscous substance, to the water, after which bubbles of large size and great strength may be formed, which retain their shape long enough to permit elaborate inspection. Another proof of the tensile force of water may be shown by pouring it from a perforated vessel on a smooth pool, when many spherules will be seen to roll over the face of the placid sheet for some time before melting into its body. It is said that a stratum of air intervenes between the drops and the pool; but what enables each drop to retain its sphericity if it be not the tensile strength of the water?

The rushing of the molecules of protoplasm, under the stress of the inflammatory process, has many degrees of rapidity, hence the variety of the so-called products of this process. It may be

affirmed that the first degree results in *pus* — a simple inoffensive body of dead blood,— fluid and corpuscular; the second degree in *sanies* — an offensive, decomposing mass of dead blood, evolving sulphuretted hydrogen; the third degree in *ichor*—a yet further disintegration of blood, mixed with dissolved and rotten tissues,— soft and hard. All that follows in this disgusting recapitulation (of demoniac possession) is the complete subversion of physiological dominion by chemical control of the elements of flesh and bone. . . .

How do we subdue fire? First, by cutting off the supply of fuel; second, by quenching the flames. How is this last best accomplished? Not by water, unless it be sufficiently abundant to flood the whole body of the combustible on fire; but by enveloping the whole mass in a sheet of carbon-dioxide, or any fluid or vapor having no affinity for oxygen, or into which oxygen does not enter as a constituent. Where the fire is well kindled, in an obscure building or part of a structure, it may be wise to isolate that locality and allow the fire to burn out. Just so in local inflammations in territories that can be cut off, preventing contamination of the whole system, it will be wise to ligate or compress the channels of neural and blood supply, until, by thus establishing physiological rest, the morbific form of metamorphosis is arrested. Afterward normal nutrition may be depended upon to spontaneously take charge of the territory upon the re-entrance of nerve and blood supply.

Paronychia ("run-round"), which is an acute inflammation, has often been aborted by persistently plunging the finger into lye of wood-ashes at the boiling point, dipping it in and out at intervals of a few seconds, until the nerve-currents and blood-currents were so controlled as to discontinue the pain and swelling. Whenever this method is vigorously and persistently pursued, a rapid cure is attained. Even that terribly painful periosteal inflammation called felon may be aborted or cut short by tightly bandaging the finger or thumb. To be sure some pain may follow this method, but it is better to pursue this course, even though no anæsthetic be used to bridge the period, than to let it run its own course to full suppuration. The safest anæsthetic to use in such cases is ice, or ice and salt, to produce numbness of the part, until the retrogressive metamorphosis may be controlled. Evaporating lotions of various

substances are worthy of trial,—one of the best of which is common ether (falsely called sulphuric ether). Rhigolene is also efficient. . . .

Depletion by diaphoresis, catharsis, or phlebotomy, coupled with nauseants pushed to the accomplishment of the purpose (viz: the arrest of inflammation), are methods within the reach of all, and absolutely harmless in the hands of ordinarily intelligent patients and practitioners. Bandaging answers a valuable purpose in our efforts to produce physiological rest of inflamed territories. Strips of sheet rubber, judiciously applied, are excellent means to drive back the excess of blood in the extremities. In cases of bruises, or loss of tone of the capillaries from any privation of nerve-currents inducing sugillation, such as the petechia (or flea-bite) of low forms of fever, the application of a succession of layers of contractile collodion is an admirable means of removing the blood from these extravasated spots, and from the congested capillaries. Eruptions of all sorts that appear as pimples, if left to themselves, may be successfully treated by the use of collodion, applied in the manner indicated, and faithfully renewed whenever it cracks, until the danger to the face, neck, and exposed portions of the skin, is past. All this is applicable to the prevention of pitting in small-pox.

With these principles and remedies and methods of applying them, coupled with a little common sense and entire control of the patient, no one is justified in allowing inflammations to run their natural course, as is the almost universal practice among general and special surgeons.

Let us examine the excretions of the human body while in febrile action, and see if the difference between health and disease does not consist in the more rapid combustion of the nitrogenous tissues. In healthy or normal activity the stored nitrogen remains constant in quantity, the system appropriating precisely as much as is eliminated in a given time. During the continuance of fever the amount excreted is many times as much (from two to seven) as the system appropriates; and this is of course, in part, at the expense of the stored up nitrogen in the blood-corpuscles, muscular tissue and albumen.

In seeking for the cause of this difference of waste, pathologists have been driven to the acceptance of a "contagium," or "materies

morbi," as the immediate agent of disease. In this view the "contagium" is a "lighted torch," whereby the special example of combustion converts the tissues into the resultant products of water, gases and ashes, at the point where the "contagium" or "infection" takes hold of the elements of the tissues. The ashes are composed of salts of soda, potash, lime, iron, etc. Where all these salts are eliminated in due proportion, we have the example of physiological wear; where the potash is eliminated in great quantity and the soda suppressed, fever is manifested in the degree of departure from the normal balance of eliminative currents.

REPORT OF COMMITTEE

ON

DENTAL EDUCATION.

By J. N. CROUSE, Chairman.

TO our colleges must we look for needed reforms in dental education, for they determine the standard of education for the future dentist; therefore, my report will be chiefly devoted to the subject of dental colleges, and, in connection, the much discussed but yet unsettled question of whether dentistry shall be a distinct profession or a specialty of medicine.

In the first place, we believe there should be a concert of action at least on some of the vital points in the management of our schools. If there could be unanimity enough in the different college faculties to form an association and to adopt certain regulations in regard to the schools, we believe the profession at large would support them in any advance movement, or in adopting as high a standard of education as they might see fit.

If they would all require each student, before entering, to have not only a thorough education in the various branches taught in our public schools, but sufficient knowledge of the higher branches to be able to at least comprehend the lectures as they are delivered, this would be one step in advance.

Next, when a student is prepared he should be allowed to enter the college, regardless of how long he has been with a preceptor, instead of requiring that he shall have studied with a preceptor two years; which means, in a majority of instances, that he has done the menial service for some practitioner for two years, and has made but little of that preparation which is necessary to enable him to derive the full benefit of the lectures.

Then, if such a degree of proficiency should be required as would take the average intellect three courses of lectures of eight

months each, the profession at large would endorse such a movement with wonderful unanimity.

Even more; if the college faculties should insist upon all dental students having a good medical education, the profession would say amen to such a step.

Again, the general sentiment of the profession is that there are too many colleges.

I reported, last year, twelve dental colleges in this country, besides several others in an embryonic state, in various stages of development. Since then there have been two births, but so far as I know there are no deaths to report.

The question of how our colleges can be best conducted, whether in connection with medical schools or independent of them, seems to be as far from being practically solved as ever.

Of the two dental schools founded during the year, one, the Western College of Dental Surgeons, is independent; the other is in connection with the University of Pennsylvania.

The Western College of St. Louis, as per announcement of its founders, was gotten up for the purpose of taking a step forward in the cause of dental education.

The announcement says that it is founded on the principle that no one knows as well as the practicing dentist the kind of instruction a dental pupil needs at the outset of his career. Therefore, its instructors are gentlemen in daily practice of dentistry as an occupation. It says, further, that the incorporators believe the true way to promote the cause of dental education is to raise the standard of requirements of dental graduation. It also says that they believe in allowing any one who is qualified to pass the examinations, to receive a degree without attending the lectures.

These are the main points, in brief, upon which this new school is founded. Like most of the colleges that have been started from time to time, this one proposes to make advancements in dental education.

The first, and what appears to be the chief, difference in this organization and the one on which the improvement is based, is the "principle" that no one knows as well as the practicing dentist the kind of instruction the dental pupil needs at the outset of his career; and on this account the faculty is made up entirely of practicing dentists.

It is difficult to see how this change is to make much of an advance in dental education; for in the first place several of our schools are already following this plan with the exception of the chair on Anatomy and Therapeutics, and, in some, Chemistry and Physiology,— all of which branches can be best taught by the one who knows the most about the subject and has the best faculty of imparting knowledge, regardless of occupation. There can be no objection to his being a dentist if he possesses the knowledge and the ability to teach what he knows. But if I have a correct idea about it, the practicing dentist, educated in a dental school alone, will know much less about Anatomy, Physiology, Pathology and Surgery, Therapeutics, or any of the subjects in medicine, other things being equal, than the medical man who has received his education in one of our best medical schools. One reason for such being the case is that, as a general thing, while preparing for college, the dental student spends a large share of the time working in his preceptor's laboratory, learning the mechanical part of dentistry, while the medical student is reading his books. The same is true after enter entering college. From four to five hours each day are spent by the dental student in the clinics and laboratory, learning the details of practice, which time is spent by the medical student in attending lectures or reading his books. So that if the instruction be equally good on the subject named, in the dental school, the medical student has given them more time and study, hence has a better knowledge of them. So that the claim of superiority on account of the faculty being made up entirely of practicing dentists will not stand the test, the facts being that they are not generally as well informed as medical men on subjects connected with medicine, which are taught in dental colleges, for the reasons already stated.

In fact, if my arguments are correct, the faculty made up entirely of practicing dentists, on general principles, must be inferior to a mixed faculty of both medical and dental practitioners.

The only other part of the policy of the Western College which we propose discussing here is that of granting diplomas without an attendance upon lectures.

It would seem but right to grant a diploma to such men as are fully qualified to practice, without requiring them to attend lectures to secure one. Indeed, it would advance the interests of the

profession rapidly if all who were fully qualified were granted diplomas, and then such legislation secured as would prevent those who could not pass the examinations from prefixing "Dr." to their names.

The granting of diplomas without an attendance upon lectures should only be done where the candidate is fully qualified, and, it would seem to us, only by such a board or faculty as are of well known ability, and have the entire confidence of the profession.

It would seem as if the faculty of this new college is made up of two few men who are thoroughly known in the profession to take upon themselves the responsibility of granting diplomas without an attendance upon lectures.

In fact it would be better that the power be outside of any one of our college faculties. A board made up out of an association of all the respectable college faculties would be much more likely to yield satisfactory results. At least it should be such, and only such, a board as would meet the approval of the profession.

Just here it may not be out of place to incidentally ask whether state societies or examining boards should grant diplomas to those who pass the examinations required of them by a legislative law, such as has been secured in some states. If any other state except New York does this it is not known to the writer. It grants the degree of M.D.S., which title we see used very freely at times by the holders. It would seem better to grant a simple certificate of having complied with the law, thus doing away with both diplomas and titles which are used sometimes improperly.

The other new college to which we referred, in connection with the University of Pennsylvania, is on a different plan from the Western, being in connection with a medical school, although not unlike in this respect several of our dental colleges.

This school starts out with very complete equipments for clinical purposes, lecture rooms, etc., and the teachers are well known as men of ability. A majority of the chairs are filled from the medical department of the University, two of the faculty only being practicing dentists.

The addition of a dental department to such an institution as the University of Pennsylvania would seem to be an addition to our dental schools which should be a cause of congratulation. There are some features of it, however, which may prevent it from

taking the advance step which the dental professors in it anticipate. In the first place, it is hard to get medical men to realize that dentists should have a medical education, and if the size of the class govern their compensation for teaching, it is quite natural that they should not insist upon so thorough preparation, if such requirements should tend to diminish the size of the classes.

I do not wish to suggest that this move on the part of the University of Pennsylvania is a money-making scheme, but it is reasonable to suppose, on general principles, that the cause of dental education is but secondary to those outside of the dental profession, and it is likely to be so in the case of this University unless the dentists connected with it have sufficient interest with the powers that be to make what I believe they desire—an advance in dental education. The same holds good in all similar institutions.

For, if I have a correct idea of human nature, we need not expect, so long as we insist upon being an independent profession, that those outside of our ranks are going to take a very great amount of interest in how much education we have, except as they are influenced individually. Even with the medical profession, although there is an acknowledged relationship between us, it is too distant, as at present held to be, to get their full sympathy.

We see a decided disposition on the part of some of the regular schools of medicine to add a dental college, which, of itself, is quite gratifying, as showing, at least, their appreciation of our strength. Some good may grow out of this in bringing the dental students closer to the medical schools, which will have a tendency to cause some part of them to take a full medical course. At least it gives them good medical instructions in as far as the dental course requires them to study medicine.

There is, however, a danger to be apprehended from this disposition on the part of medical schools. It is the increasing of the number of dental schools; forcing, as it were, an increase without the profession at large, or the dentists in the immediate vicinity, being able to prevent it.

It would seem to me that the degrees conferred by the dental colleges in this country should be uniform, and, as the title of D.D.S. is the oldest, and has been adopted by all the colleges save one, that *this* should be universally adopted unless some other can be found that will express more appropriately the nature of

our calling. Certainly the degree of Doctor of Dental Medicine has no advantage in this respect over that of Doctor of Dental Surgery.

The matter of clinics is receiving special attention in many of our colleges. Besides increasing the conveniences, a large number of clinical instructors are being appointed in addition to the regular faculty, who give stated clinics to the students of the various classes.

This policy is being pursued by the schools in Philadelphia, New York and Cincinnati, and perhaps others that I am not aware of. This addition to the usual teachings in the practical part of dentistry can but result in good to the student, and it would seem as if all the schools could adopt this plan of teaching with advantage to their classes.

The Pennsylvania College of Dental Surgeons has gone into much enlarged quarters, has added anatomical rooms, and requires that each student shall dissect during one session of his course. It and the Philadelphia dental college have also arranged with the Jefferson medical college, whereby graduates of their schools can become candidates for graduation in that institution by attending one course of lectures.

The same is true of the dental department of the Universities of Pennsylvania and Michigan with their medical schools. About the same arrangement is made by the New York school with one of the leading medical schools of that city. I believe that similar plans have been adopted by some of the other schools.

Quite a number have also increased the length of term of lectures; in addition to the spring and summer courses, requiring five, instead of four, months in the regular or winter course. The Harvard school has increased its course to eight months, and requires attendance during the two full terms.

These various changes show a desire and a determination on the part of some, at least, of our dental colleges to make advancement. But the change which must come sooner or later,—and from various indications it would seem must soon come,—is but a change from the partial to the complete, and in this evolution dentistry steps into its place as a branch of the science of medicine.

To be more explicit, let us urge that the dental student first be medically educated, then dentistry follows as a specialty of

this liberal education, just as does ophthalmology, dermatology, obstetrics, gynecology, etc.

If those universities and medical colleges which have attached to them dental instructors had adopted this plan, they would certainly have received sympathy and support from a majority of the intelligent members of the profession, but thus far they have only opened more dental colleges, giving a partial degree representing partial instruction, and the opportunities they offer do not excel those afforded by our best dental schools.

It cannot be denied that the teeth are an important part of the human economy, and that unfavorable systemic conditions are as positively and certainly impressed upon these organs as upon any others.

Improper nutrition from any cause is so unmistakable in its results, that the dentist, to fulfill his mission in the highest acceptation of the term, should be not partially but thoroughly educated in medicine.

The natural inquiry arises, would you require the dental student to spend more time in his preparation for practice than is demanded of the medical? We answer, not more than is exacted from the specialist in medicine, who, after acquiring his degree of M.D., has but just commenced the preparation for his life-work. Preceptors, infirmaries, clinics, both at home and abroad, are sought that he may more thoroughly learn the relative importance of the parts he has chosen to treat, their intimate relation to the animal economy, etc.

The practice of medicine is daily becoming more and more divided into branches, which we term specialties, and students who expect to practice any one of these obtain the degree of M.D. only as a preliminary step toward the acquirement of that special knowledge which is requisite to perfect them in such branch of medicine as they may have elected to practice. Now, this course leads to what we call a *higher* education, and those who adopt it acquire the greatest success as practitioners. To what extent we, as an association, can foster this plan, or force the dental student to adopt it, is open for our consideration. But while working to secure this — our most complete conception — we must remember that advancements in education, like those of individuals and societies, are rather of spontaneous than artificial growth.

REPORT ON DENTAL EDUCATION.

By THOMAS FILLEBROWN, of the Committee.

ONE year ago this Association passed by a decisive vote a resolution declaring a thorough medical education essential to the most successful practice of dentistry. A resolution declaring it expedient and practical for medical schools to add dental instruction to their curriculum, and thus afford opportunities for dental qualifications for students as well as in other branches of medicine, was not passed. The reason of this, I feel, was largely due to a misapprehension, through lack of a full discussion of the matter; and for this reason I call your attention to this point again, asking your thoughtful attention to the subject and its careful consideration, and also such action upon the question as shall, in your judgment, best promote the interests of educated dentistry.

As germane to the question, and necessary to the full understanding of the further discussion of it, I reproduce a synopsis of the points made in my former report.

In that report it was assumed that dentistry is a specialty of medicine, because it is so written in the preamble of this Association. That a medical education is but the foundation which prepares its recipient to perfect himself in whatever specialty he may choose to practice.

Though an ophthalmic or aural surgeon, or a dermatologist or other specialist, may do much good without it, yet he needs a thorough medical education, and all would regret a state of public opinion that would tolerate such practitioners.

Surgery of the eye and teeth are as intimately associated with each other as are their anatomical relations.

Inflammation of the dental branch of the fifth pair of nerves differs not from that of the ophthalmic branch. Nor are ulceration of the mucous membrane of the mouth and eye dissimilar, and the treatment of these and other cases is governed by the same general principles.

It is conceded that, other things being equal, the medically-educated man is best fitted to practice dentistry. When a med-

ical graduate attends a course of lectures in a dental school, a noticeable respect is paid to his superior acquirements, and he will almost pass without examination. The greater includes the less, and the medical graduate has only the handiwork and technicalities of dentistry to learn. As a rule, those who have done most to elevate and improve dentistry have been medically-educated men. Our literature is the product of the same class.

Of sixty-eight standard works fifty-two were written by graduates in medicine, and those of the most scientific value.

Dental science is a part of a whole. It is impossible to fully understand a part without understanding the whole.

The operator who treats abscess, ranula, or necrosis, needs medical knowledge as much as he who cuts for cataract or enucleates the eye.

The effects of pregnancy and lactation upon the teeth are such as to refute the idea that a knowledge of this subject is superfluous.

The subject of anæsthetics also demands a thorough understanding of the best means to control their influence.

While the fact still remains that dentistry consists very largely of essentially mechanical operations upon the teeth, so far from this being a reason for less preparation, it is the strongest argument for the more thorough and extended preparation.

Specialties tend strongly to run in a groove; hence the more need of the antidote.

The expediency and wisdom of medical schools including dentistry in their courses of instruction appear for the following reasons: More schools are needed, and more widely distributed, so that more inducements and facilities may be offered to young men to obtain a good education, instead of less, as has been advocated.

Where a professional school is located, there will exist a higher standard of professional excellence. Where a dental school is established, there will be superior operators and superior patients.

The establishment of new schools has not injured those previously existing, nor would any such suffer by opening the doors of medical colleges to dental students.

The faculties of dental schools are deserving of all honor; they have advanced as fast and as far as the profession would support

them, and their hands should be upheld. The proposition to include dental subjects in a medical course implies no reflection on them. Their advance has been in including more of general medicine in their courses of instruction, and in that direction it still must lie until they, too, will cover the whole ground, and to this they are sure to come.

The ideal dentist will first graduate in medicine, and then take a post-graduate course in dentistry. Few, however, will do this, and while taking a medical course there will be ample time for becoming familiar with the specialty of dentistry. The few mechanical principles governing the filling of teeth, and the making and adjusting of artificial dentures, are readily understood; and not many months are necessary to acquire sufficient skill in their application with which to commence practice. With the general medical principles involved, it is different — those can only be acquired by prolonged study, extending over several years. And no amount of simply dental knowledge will give a man more than a partial culture.

In case a student makes a mistake in entering the practice of dentistry, being not well fitted by natural abilities for it, if medically educated he may correct his error by seeking some other branch of practice; and the contrary is also true, and many a poor doctor, with superior surgical talent but no opportunity to use it, might become a brilliant dentist.

The favorable action of the Cumberland County (Maine) Medical Society, the Maine State Medical Society, and the Portland School of Medical Instruction, were quoted to show the sympathy the medical profession feel toward dentistry as a specialty of medicine, and their desire to meet any approaches more than half way.

In the discussion on dental education last year, it was quite evident the plan by which dental instruction was to be given in medical schools was not clearly conceived, and, of course, not well understood nor sufficiently discussed to produce any common understanding of the question or unanimity of opinion among those who are already in favor of the movement.

In order that we may make some progress toward a definite opinion on the question, I present it at this time.

Dentistry, as a specialty of medicine, is, perhaps, more distinctly a branch of surgery, but in either case distinctly medical, and

deserves full recognition as such by dentists as well as by the more general practitioner, and should be included in the course of study of every person who presumes to have a good medical education. Indeed, no one can presume to be completely educated in medicine unless his studies have extended well over so important a branch as dentistry.

It is not well for any student to give principal attention in the beginning to the simple practical part of any subject, if he wishes to become master of it; he must first attend to the principles upon which it is based, and let the practice follow.

Such is the custom and policy of every profession — practitioners of dentistry not excepted. With these it has been the main idea to become sufficiently skilled to make a set of teeth, and to make a passable filling, and be able to wrench out a decayed stump with a degree of skill that shall save from a conviction for malpractice; then seeking only as much of the knowledge of the principles which underlie all practice as they may feel obliged to do to secure a diploma.

I am glad to feel assured that the present is not colored quite so darkly as this, but still I feel that the blot is not all washed away.

Thirty-two teeth, however well understood, are not enough to establish a distinctive and liberally-educated profession upon, and just in the degree that we confine our studies to this point alone shall we fail of becoming liberally-educated men, and just in degree that the education of dentists embraces the principles of a general medical knowledge will they be able to lay claim to be men of wide culture in their chosen line of practice.

"First a generalist, then a specialist," is a proverb we cannot too often hear nor too fully heed.

It has been assumed by many that if dentistry is taught in medical schools, it will be taught by instructors not practising dentistry. Objection to the plan must have been father to the thought, for nothing can be farther from the reasonableness of the thing, nor farther from the practice long well established in medical schools of this country, excluding occasional exceptions in case of anatomy and chemistry. The invariable rule is that professors and lecturers in every school are men in active practice in their several branches, and lecturers on special subjects are selected in every

case because of their activity and success in the practice of their specialty. No different rule could apply to dental instructors. Any school that wished to teach dentistry would and must select those men for instructors who know the most about it, and none can know except they be in active practice.

This seems a proposition so evident as to need no argument, and no other idea can be entertained upon which to base any proposition looking to a consummation of such an arrangement.

A crystallization and expression of opinion upon this question becomes the more desirable and important at this time in the light of the fact that so many new schools are being established, and that old, honored and cultured universities are taking upon themselves the perpetuation of a partial degree, thus binding the bands about us the more firmly. Harvard University, in doing such a thing ten years ago, was taking a long stride in advance of the opinion of the day, and going adverse to many prophecies of failure.

The University of Pennsylvania, doing the same to-day, is but trailing a long way behind the well-pronounced judgment of a very large portion of the better qualified practitioners and thinkers of the present time.

The argument that the more advanced action would not be sustained is, I believe, not true; and if true, not applicable to a case like this. Such a time-honored and wealth-honored institution ought to take and maintain the most advanced position in any department it may adopt, and cannot afford to do less.

I can only add a word of regret that dental education should have thus received a check from this source; but it only retards a little; the movement will go on until full success is reached.

What would not be said in condemnation of the action of any university in the land that should establish a partial course for ophthalmic surgery or dermatology, or any other specialty save dentistry, and confer a degree for the same! Public and professional opinion would not allow it. Now, what can be said of this one exception of dentistry, save that, like the sin Pope writes of, public opinion has learned to endure, pity and embrace?

Michigan and California universities of course share with the others in my regrets. They might, all of them, to-day be giving dental instruction by the same able and worthy teachers, and giving their dental graduates the well-rounded instruction and title of M.D., practicing their specialty of dentistry.

Another thing that keeps the dental degree second to others is that, in many of our schools, branches that are pursued in common with a medical course are passed less thoroughly upon in examination than is expected of medical students.

So long as this state of affairs exists, dental students will be second rate in their scientific acquirements. There will be individual exceptions, but the rule will hold good.

The considerable number of students that take first a medical course, and then a dental course afterward, shows that there is quite a demand already for a medical education for dentists. And it is none too soon for the opportunities to be offered those who are willing and desire to take the broader instruction; and as a matter of justice to them, they should be afforded these facilities in their medical course.

The way seems to me very plain and very easy. If Harvard, Michigan and Pennsylvania universities had made just the same preparations for clinics and for infirmary practice, and had appointed the same worthy and able men as instructors, and then said to the public and to their students, "Dentistry is medicine: any one who wishes to study dentistry can come here and enter the medical department of these institutions, and study it the same as any other branch of medicine is studied, and graduate under the same rules, pass the same examinations, and receive the same degree, and possess the same culture and ability, as far as they are obtained here,"—this would have been the perfect solution of the problem, and in my judgment, the result would have proved to be signal success.

Had this been done, or should to-day any number of other medical schools take such a step, there would be no antagonism between them and existing schools — these are already established, and would not suffer in any way; it would only make it the easier for them to do what they all so much desire, i.e., to raise higher the standard of dental education.

D.D.'s, D.M.D.'s and M.D.'s agree perfectly well in this Association, and they would if the M.D.'s were doubled in number.

This Association considers the degree of M.D. a sufficient credential of scientific fitness for admittance to membership in this body. It believes dentistry to be a specialty of medicine. It believes a well rounded medical education essential to the most successful practice of it.

I wish I might add a belief in the legitimate sequel,—the advisability of medical schools offering to their students instruction in this most important branch of medicine.

If objection is still raised that such a course will not afford time for acquiring skill in dental practice, I will again refer to the fact that so large a portion of dentists practicing to-day entered upon their professional life with much less dental preparation than this would afford, and their success has justified their course.

Less schools and better, I repeat, will not avail; making less will not make better, but the opposite. Competition is the life of schools as well as of commerce. The efficiency of our dental schools has increased in a steady ratio with the increase of their number. The number will inevitably further increase — no power will prevent it — and the duty of this body is to so exert its influence that it shall aid in increasing the thoroughness and breadth of the instruction there to be given.

Let us not be anxious about the recognition physicians, or any one else, may extend to us as dentists, but let our anxiety be that we ourselves, as well as physicians, properly recognize the importance of dentistry as a medical science and medical practice.

And when physicians know as much about dentistry as they should know, and when dentists know as much about medicine as they should know, all question about recognition or mutual respect will cease to be raised, and there will be no more "sickly sentimentality about claiming fellowship with a profession that disclaims us"; for all will be of one family, owning the same Alma Mater, and laboring for the same common good — the amelioration of human suffering and the elevation of the human race.

Such a plan was proposed by Dr. Gardette, of Philadelphia, so long ago as the time when the Baltimore Dental College was chartered. How vastly better for the practice of dentistry had his influence prevailed and his plan been adopted.

That this Association may record its action in favor of a "consummation so devoutly to be wished," I offer the following:

WHEREAS, Dentistry is a specialty of medicine, and requires, as do other specialties, a thorough medical education as preliminary to its most successful study and practice;

Resolved, That we deem it expedient, and for the best interests of the practice of dentistry, that existing medical schools so enlarge their curriculum as to include efficient instruction in dentistry, and thus make the requirements for graduation the same for this as for other specialties of medicine.

REPORT ON DENTAL EDUCATION.

By GEO. J. FRIEDRICHS, of the Committee.

IT is with considerable hesitancy that I present this paper on Dental Education, being well aware that there are many in this association who could have done the subject more justice. But as you have seen fit to appoint me as one of the committee, with the implied expectation of hearing from me on this subject, I will, to the best of my ability, try to give you my views and opinions.

The day of private tuition has gone by; the public and the profession demand a collegiate education in dentistry.

The sense of this association, at its last annual meeting held in Chicago, was thus expressed:

"Whereas, Dentistry is a specialty of the science of medicine;

"*Resolved*, That we esteem a sound and thorough medical education essential for the most successful practice of it."

From the above dictum it would follow that, in order to be or become a successful dentist, one must first obtain a degree in medicine. Now, although the holder of a medical diploma *atque jura*, is presumably qualified for the practice of all specialties — since a diploma in medicine is supposed to cover the whole ground,— yet, as the science and art of dentistry are not included in the curriculum of a medical course, it naturally follows that the scion of medicine who wishes to devote his acquired knowledge to the treatment of the oral cavity and the preservation of the teeth, must receive the necessary instruction for this from some other source than the medical school.

What has the student learned about dentistry in the course of his medical studies? He has hardly learned how to extract teeth, let alone the higher art of preserving them. He may have acquired a knowledge of the anatomy of the mouth; but aside from this, would be no more competent to practice the art of dentistry than a first-class tinsmith would be to construct an artificial denture.

The medical profession, for some unaccountable reason, has been averse to recognizing specialties. Yet in the science of

medicine there is one specialty that has been recognized as appertaining to it,—that of ophthalmology. Therefore a regular graduate in medicine ought to be an ophthalmic surgeon. But such is not practically the case; otherwise graduates in medicine would not give their time and money to become pupils of celebrated oculists, such as Von Gräfe, of Berlin, and other celebrities in this specialty, in order to complete their studies, and thus make themselves competent practitioners.

The same reasoning holds good in regard to our specialty: a doctor of medicine would either have to enter for another course in one of our dental colleges, or get his instruction through a private source from some competent dentist.

Now as to specialism. Dr. Beard observes, "that success, even with the most richly endowed natures, is only possible through specialism. It is peculiar, as some would believe, to modern science or recent civilization, yet all the famous Greeks were specialists. In the present century science has become so specialized that all the advances are made by specialists in comparatively restricted fields. In spite of all criticisms, the work of specialization has gone on, and, in obedience to the law of evolution, must yet go on. Those who have confined their study to particular branches are our best authorities. Science and specialism are identical; not to specialize is to lose the prizes of life. Germany, which in philosophy and science does the original thinking of the world, is, as we all know, a nation of specialists."

Dentistry being a specialty, must be taught by specialists, in the art, who are in actual practice; but a medical course ought to precede such instruction.

This is the position that has been already assumed by this association, and to me it seems a healthy sign, giving promise of a higher standard of education for the coming dental surgeon.

In considering this subject, we must bear in mind that there are two objects to be kept in view; one is the education of the mind, the other the education of the eyes and the hands. To the former belongs the theory, to the latter the practical application. Of these two, the practical education is the more important, for without it a successful practice in dental surgery is out of the question.

In tracing back the history of dental surgery in this country, we find that "Dentistry was introduced into the United States by

Le Mair, of the French forces which joined our army during the revolutionary war." The first American dentist was Dr. John Greenwood, of New York, 1788. In 1820 the profession numbered a little over a hundred; in 1832 about three hundred; twelve years after, fourteen hundred, and at the present moment is estimated at about ten thousand.

In view of this rapid growth, and of the fact that medical schools did not teach dentistry, and inasmuch as private tuition was found to be insufficient, and the necessity for instruction in our specialty was growing imperative, our predecessors followed the only course which seemed likely to meet the exigency, and organized institutions for teaching dentistry exclusively.

The initiation of our dental colleges was an advance toward a higher standard in the profession, and the dentists of to-day owe a debt of gratitude to the organizers and teachers in our dental schools for their labor of love in this field; for it is well known that they have not been adequately remunerated for their services given in this cause for the past thirty years, and through which the profession, as well as mankind in general, have been benefited.

Yet I think there is still room for improvement in the practical teaching in the infirmaries connected with our colleges. In looking over the annual announcement of the Pennsylvania College of Dental Surgery, session of 1876–77, an institution which I believe will compare favorably with any similar institution in this country, I find, by their own admission, that the number of fillings inserted per student for the past five years only averages thirty-six. In the session of 1875–76, if we leave out such materials as require hardly any skill in their manipulation, and confine ourselves to gold and tin, we find the average per student twenty-nine and one-seventeenth. As this school requires the student to attend two courses of lectures before he can graduate, and admitting that he would perform an equal amount of fillings during each session, we have the total amount of operations fifty-eight and two-seventeenths for each graduate.

Now, I will leave it for you, who represent the high standard that dentistry has attained in this country, to say whether a graduate from our dental colleges under these circumstances is competent to practice the art of dentistry.

I may be met with the assertion that *some* would be competent.

True; so we have had most learned and eminent men who never received a collegiate education; but their number has been, "like angels' visits, few and far between."

The most important operation in dentistry is that of filling. Any one who sets himself up to perform this operation, and who is not competent, is, in my estimation, worse than a thief. A thief steals only filthy lucre, while a dentist incompetent to fill a tooth properly adds abuse to injury, for he not only inflicts unnecessary pain, but steals his patient's time and money. He gives the assurance that the tooth operated upon is put in a condition for future preservation, while before a competent operator is consulted caries may have progressed to such an extent that the vitality of the tooth is endangered, and an irreparable loss to the patient may ensue.

Recent graduates in medicine are not supposed to be as competent as practitioners of years of experience, and all that is expected of them is, that they have acquired the general principles upon which is based the science of medicine. A course in medicine is only the initiatory step upon which the graduate is to build in the future by continued observation and study, as the field in the science of medicine is so large that no human mind can grasp the whole of it, and become competent in all its branches.

Therefore I am willing to concede, when a medical faculty affixes its signatures to a diploma, we must allow it more latitude than we can that of dentistry. The latter being a specialty can be acquired more thoroughly, and I question the right of a dental faculty that licenses and authorizes incompetent parties to practice the art of dentistry.

In view of these facts, I would recommend that the president of this association be authorized to appoint a committee of one at every place where a dental college is located, to report to this association the advantages possessed by each for the practical teaching of the science and art of dentistry. As practical anatomy cannot be learned without material for dissection, neither can you learn how to fill teeth unless you can have patients that require teeth to be filled. This association being represented by delegates from all parts of this country, having the standing and welfare of the profession in view, belonging to no dental college or clique, has the right to investigate this matter, and to recommend such insti-

tutions as possess and offer the greatest advantages to students who may wish to acquire a thorough dental education.

For who are to define the requisite qualifications of a dental education, and who are to say who shall be the educators, if not this association? Certainly not those outside of the profession. In the words of Prof. McQuillen: "As the profession has been elevated from its primitive condition through the successive labors of innumerable minds, it is alone by the continuation of such efforts, on the part of those who succeed them, that the point reached can be maintained, and additional advancement secured." Consequently the blame, if any, lies with us if students do not in the future obtain a thorough professional education before receiving a diploma or a license to practice dentistry.

DISCUSSION.

Dr. R. Finley Hunt: The general objection to the proposition contained in the resolution of Dr. Fillebrown is that we are putting dental education beyond our control. We have brought it up to its present standard as being members of the dental profession, and not members of the medical profession. We have done this without the aid of the medical profession, by our own exertions. We are anxious to promote the cause of dental education, and to elevate the standard; but if we place this matter in the hands of the medical profession entirely, by throwing our means of education into their schools, we shall thereby put the matter outside of our control, and in the hands of others who have taken no part in the work we have been doing. With reference to the education in a dental college, we admit the justice of the position taken in the papers read, and I refer especially to that of Dr. Fillebrown, that a medical education is necessary to the proper practice of the dental profession. The paper proceeds upon the supposition that the dental colleges do not give a medical education. That is in fact a mistake. Every dental college has a faculty, and the professors teach every subject,— physiology, anatomy, pathology, etc.,— that is taught in medical colleges. Then the question arises, not on the means that we have, but the efficient, conscientious use of those means. The expression was made use of in Dr. Fillebrown's paper, of "simple dental educa-

tion." If he means by that simply the operation of filling teeth, I will grant that he is right; but I contend that the education taught in a well-conducted dental college is not what he means, I presume, by "simple dental education." A dental education properly taught in a well-conducted dental college includes a thorough knowledge of medicine in its generalities. Whether we are a distinct profession I do not think enters into the discussion of this subject; we are all aiming at the same object,— that is, the thorough and proper dental education of those who enter into the profession. The only difference that arises is as to the means we would use to attain that end. I think if we could have more thorough unanimity of action, and more thorough consultation as to the use of the means at our disposal, we should arrive at more satisfactory conclusions regarding the best method of securing a proper dental education. I therefore give notice that when this discussion is closed, I shall move to refer this preamble and resolution to the section on dental education, so that we can mature it properly, and have the results of combined consultation of all the members of our association who take an interest in, and who have given thought and study to, the subject of dental education.

DR. INGERSOLL: As I understand the resolution and the reports, the proposition is to give the same degree to the man who proposes to practice general medicine and the one who proposes to practice dentistry. Is it understood that a medical man shall be required to be an educated dentist?

DR. FILLEBROWN: In theory he must be, just as fully as the man who is to practice dentistry.

DR. INGERSOLL: I remember in reading over the constitution of the first dental society organized in this country, there was used this language with reference to the object of the organization, "to make the dental profession respectable." It has ever since been the effort of dentists to raise themselves in the respect of the community, and in their relations to the professions generally. It has been observed by men in other professions that the tendency has been downward rather than upward. This is true, no doubt, in theology, law and medicine. In the present effort of the dental profession to elevate the standard, it seems to me we are beginning in the middle of the ascending scale rather than at the beginning. We have not so much need of full medical education as of ele-

mentary and general education. I could not be satisfied with any man pursuing simply a medical course as a qualification for him to enter upon his dental course. It seems to me we are making too much of this and too little of the preliminary qualifications. I have had some knowledge of the methods by which young men qualify themselves for the practice of medicine. A young man who has for two or three years attended a doctor's horse, and imagines that a doctor has an easy life, says, "I believe I will be a doctor"; and he goes to a medical school, with not even a common-school education, enters that medical college, and graduates as an M.D. I have known large numbers of medical graduates, and I know large numbers of them to-day in practice, having what is considered a successful practice, who could not write three lines of English correctly. These men did not begin at the proper starting-point. The estimate which this society puts upon a medical education, as a means of making the dental profession more respectable, is too prominent. We must go back to the old proverb, "'Tis *mind* that makes the man."

Unless the college faculty shall insist that their students shall have some preliminary literary training and mental culture, how can they be expected to understand the meaning of scientific terms? All thought is wrapped up in language, and language is the only medium of communication. If students of dentistry cannot comprehend the meaning of terms—which education alone can enable them to do,—how are they to comprehend the language of the books they study pertaining to this important specialty? Unless their minds are trained to systematic thought, how shall they comprehend the subjects which they are called upon to investigate? Therefore I would say, there must be a *beginning* at the *beginning*, before the dental or the medical, or any of the professions will be improved and elevated to a high professional standing, and obtain the respect of educated people. When I entered the dental profession, my friends were sorry to have me do so, because of the low professional standing of dentists of that day, and I was for awhile ashamed of some of the company I felt obliged to keep. I feel so no longer. To-day I must bow humbly before this body of men. You will allow me to repeat that we must elevate the dental profession by beginning at the beginning—at the very substructure of all education, before we can talk confidently of the superstructure of a medical education.

Dr. TAYLOR: Hearing the remarks which have just been made, I could not but wish that Dr. C. A. Harris were present, that he might see the interest which is taken in dental education. It throws me back to the time when we had no dental colleges, and when there was not a medical school in the land that would receive us. At that time our medical schools said they could not enlarge their curriculum of study; they had already too much. If the gentleman who introduced this resolution will go a little further and say to those colleges, extend your studies to three years, and give us a thorough medical education,— I will go heart and hand with him. It is just what we want. I should be glad to see every medical man in this land able to appreciate the science of dentistry, and to comprehend dental disease. We do not find this the case. Are we in the right mind to remedy this defect? I claim that we are. We have brought our profession up to the standpoint where the medical profession are ready to embrace us. What do we care for recognition? We only want to be recognized as a thorough-going profession, able and willing at all times to assume the duties and responsibilities which rest upon us. I recollect so well, in my early life, our friend Dr. Harris and myself were practicing dentistry in neighboring towns. Both having previously practiced medicine, we came to the conclusion, after following dentistry one or two years, that if we continued in this specialty we must have dental colleges. There are but few of you who can appreciate the condition of things then, or have any conception of what dentistry then was. I look around and see the advantages which our young men have now, and feel that we are in a different atmosphere. And yet it appears to me as if the profession were not satisfied with our dental colleges. When our dental schools were first organized, we had a chair of anatomy, of pathology, of practical dentistry and of mechanical dentistry. We have now introduced almost every department of medical science they teach in the medical schools, and I need not be told that our graduates cannot stand a thorough examination in anatomy, physiology and chemistry, for they can, and they do, do it. I have not been in connection with a dental college for years, and yet I know from practical observation and from the assertions of gentlemen engaged in the teaching of medicine, that this is the fact. A few years ago you could not have had such a discussion as we have had in the last two days, in any den-

tal association in the land. All I think it is necessary now to do is to go on in the work. I think the dental institutions should extend their curriculum of study every year in proportion to the demands of the profession. If you who are engaged in practice demand that our course of study shall be enlarged, it will be done.

Dr. FLAGG: Joshua Billings, a man universally known and highly esteemed, has said that "Sensible people are those that think as we do." From that standpoint I view the last speaker as an eminently sensible man. I have had my say on this subject. I merely wish to state that the medical colleges have taken this matter out of our hands, and we can see now how the various departments in medical schools will work; we also will see how our colleges will work, and therefore, without any other demonstration on our part, let us go on and work too, and let us wait, for the present.

Dr. JOHN ALLEN: When my good friend Dr. Taylor was speaking, my mind, too, was carried back to the time when we had no dental colleges, no dental journals, no associations, no means of interchange of useful information between each other as we have now, and it does me great good to see our younger men coming forward and dwelling upon these important and intricate points that were not touched upon in those earlier days. It shows that our march is onward and upward. I like the idea very much as dwelt upon by our speakers, that we need a thorough education in these collateral branches. I contend that a thorough medical education is the foundation for a dental education, but a medical education alone will not qualify a man for dental practice. And it is also necessary for medical men to know more of the principles of dentistry, for the welfare of their patients. For instance, not long since a gentleman in New York became severely afflicted with his eyes. He called upon an eminent physician, who could not account for it. After repeatedly examining his case, the patient growing worse all the time, the physician said he would give a thousand dollars to know what was the matter with his eyes. Finally the gentleman called upon a dentist with whom he was acquainted, who, upon examination, found that it was the cutting of a wisdom tooth which produced the trouble, and upon the tooth being extracted the difficulty was removed. This is only one case. If you will look at the matter carefully you will see there are many cases in which the dentist, unless he has a thorough

medical basis to rest upon, will also be likely to fail to diagnose clearly what the difficulty is with his patient. The same is true with our medical men. They will frequently fail in their diagnosis for want of more knowledge in dentistry, as in the case just cited. Therefore these fundamental principles should be understood as thoroughly by the dental as by the medical profession.

Dr. WETHERBEE: I desire to add my testimony in favor of dental education. I have always been a firm believer in, and an advocate of, education. The greatest curse of the profession is, that there are many in practice who are not properly educated in the science and art of dentistry. They may have done, and are still doing, the best they can with the means and facilities at their control. Nevertheless, there has been a very commendable advancement, and after about forty years of efficient labor on the part of the colleges of dentistry, it has singularly happened that, according to the estimate of some men who have graduated on one course of dental lectures only, but are not liberally educated, and are not graduates in medicine, that they wish, apparently, notwithstanding all that has been accomplished by the *chief factors*,— the dental colleges,— within the forty years past, *to put the profession out to nurse.*

It has been said here to-day, and the resolution under discussion is in agreement therewith, that no man can scientifically, skillfully and efficiently practice dentistry unless he has a medical education. I pronounce this false! That is plain enough, every one can appreciate it. Do not dental colleges embrace in their curriculum anatomy, physiology, principles and practice of surgery, pathology, therapeutics and chemistry? So far as these several branches are concerned, are they not efficiently and successfully taught in dental colleges? If so, then why utter and fulminate this odious slander against and upon dental colleges, which have been, and still are, effective instrumentalities of professional advancement, thereby bringing them into disrepute?

If it is necessary for one to attend a medical college, is it not necessary for all? Perhaps you may say there are exceptions; some men are endowed with large intuition — are great geniuses; I will not except them. Parenthetically, if we are to have a profession characterized by the highest type, possessing the qualifications needful to command universal respect, would it not be well

to first have a liberal education, and, to insure general acceptance in all communities, study belle-lettres, theology, law, etc., that in all associations we may discuss topics and subjects intelligently with those who are accredited scientists? In addition to specified previous qualifications, I would have them graduate in medicine,—and know it, too,—although the practice of medicine is empirical. Having complied with the provisions and conditions anticipated in the resolution, the student's attention should now be given to three years' study of dentistry, with at least two courses of lectures.

If we study medicine for many years we shall be far removed from that which concerns the practice of dentistry. The student who leaves a medical college, with no special training, *is no more a dentist* than I was three days after I was born. In a word, there are no objections to thorough medical training, provided its prestige is not substituted for a thorough knowledge of dentistry.

Dr. DARBY: The views which have been presented by different members of the association are greatly at variance. Some have recommended that there be more dental schools; others that there be less. We might discuss this question for hours and years and not arrive at any agreement. But there is one point which I wish to speak about. When the trustees of the University of Pennsylvania decided to establish a dental department therewith, the question arose in their minds whether they would confer upon the dental graduates of the University the degree of M.D., or the partial degree of D.D.S. The first would necessitate the attendance upon three full courses of lectures. (It is well known to all of you, I presume, that the medical course of instruction has been extended to three years, instead of two.) Now the question presented itself forcibly to their minds whether they should compel the dental student to attend the three years' course and take his medical degree with the others, or whether for the present it should remain optional with the student to attend two courses and receive the partial degree of D.D.S., and while they strongly favored the former, they finally decided to leave the choice with the student. The plan now is that the dental student take the first year's curriculum, which is identical with the first year's studies of the medical class; the second year, if he desires to become a candidate for the dental degree,—he merely repeats his first year's studies. But if, on the other hand, he decides to take the three years' course, with the

medical degree, he joins the second year medical class, and the next session he takes the third year curriculum. (The courses are graded.) He may graduate in dentistry at the end of the second year, receiving the degree of D.D.S., and at the end of the third year take the medical degree. Time will prove whether the dental profession is ready for a full medical education for the dental practitioner, and if its members are ready, the University of Pennsylvania is willing to make the change. Facts are stubborn things, but we have to deal with facts. How many students who come forward to take a course in dentistry are prepared financially to avail themselves of the full medical curriculum, involving an increased expenditure of time and money?

If we should follow out the course which Dr. Fillebrown has suggested, it would take at least ten or twelve years to perfect one's self in the collateral branches. So with Dr. Wetherbee's course. The student would be forty or fifty years of age before he would have completed his studies, and then after living out the best part of his life, he would be ready for his degree. These are practical facts, and they must be met fairly and squarely. For my own part I would say, make the student graduate in medicine first, and require him to be thoroughly up in all its departments, and then let him practice dentistry if he desires. It is this that the University of Pennsylvania is coming to. For the present we will confer the partial degree, but we trust the time is not far distant when the profession will be ready, and will require us to abandon the partial degree, and then it will be willingly done. It may be that the next session will require a full medical course.

Dr. ATKINSON: I wish to say something with regard to this question that is so complicated and profound and manifold in its modes of presentment. Are we likely to be benefited most by the institutions that have been built upon effete and exploded theories, and that are continually inaugurating and enforcing them in their teachings, with all their prejudices in favor of the darkness? I wish to say, dentistry is medicine. I leave that out of the discussion. If we have had very little of medicine in dentistry, and very little apprehension of how a tooth should be filled, of what were the causes or the incidents that occasioned the necessity for us to operate or manipulate or prescribe for it, that only is for our own consideration, as honest men, in dealing with our patients.

Where shall we be most likely to get the truth? In this correlation of the vast mass of nonsense! or in the clear-cut perceptions where we see the sharpest light defined on the very point we wish to get at! We are here as *dentists*, (as my friend Dr. Taylor said,) because of our individual action as against the opposition of "Old Medicine," that would not accept us and teach us. Was not the kindly angel doing better for us than we had any expectation of? Were we not blest in that opposition, and have we not grown rather in consequence of it to occupy the position we now hold? By the grace of heaven we have been made to work better than we knew.

How shall we so arrange it as to utilize what there is advantageous in the medical colleges and leave out that which is detrimental?

We shall have to do it with the microscope and chemical retort, and we have the material among us to prepare for it, and I hope we shall give encouragement to all efforts that are made to arrive at the truth.

Why do the medical colleges ask for the patronage of students? Is it because they are so imbued with the truth and so overflowing with *legitimate lore* that they are bound to spread these broadcast? I am sorry that my guiding angel won't enable me to say that it is so. I have a little suspicion that the dollars and cents have something to do with it.

The increase of respect for the practice of dentistry, among medical men, is due more to this action of those universities that have instituted professorships for our specialty in their faculties, than to any desire to place the department of dentistry on an equality with medicine.

Dr. SPALDING: I shall have to pass very hastily and briefly over many topics I would like to spend time upon, but I want particularly to say a few words in relation to the college of dental surgeons, with which I happen to be connected. This college makes it possible for a competent candidate to graduate without attending a course of lectures — and why? Because it recognizes the fact that there are a large number now belonging to the dental profession, and who are creditable and useful members thereof, who did not take courses, and consequently do not hold degrees. It recognizes the fact, also, that there exists a tendency to close all

doors of access to these worthy gentlemen, and lest they might be entirely shut out, it determined to open the doors a little wider than they have previously been. That is the view the college took, and I believe it is a just and righteous one.

On this subject of medical education, and of whether dentistry is a branch of medicine, there can be but one opinion, and there has been but one that I know of. The question is not as to the abstract fact of whether dentistry is a branch of medicine, nor whether it is desirable that every practitioner of dentistry should have a complete medical education. The only question is, how far it is possible for us to enforce such a rule. We must not rush to an extreme in this direction, which will drive from our doors a large majority of those who are ambitious of becoming dentists, by making the means of acquiring a degree so difficult that they cannot accomplish it at all, and thus drive them away from the schools. The result would be that after spending a short time in some private office, they would be practicing all over the country. We cannot prevent that kind of thing. It is taking place to a great extent to-day, even with the facilities that are afforded to young men to acquire a dental education. A great many are now practicing without proper qualifications. If we too positively advance the standard of acquirements, we will only increase this practice of what we call outside quackery. The present status of the dental profession is due largely, if not mainly, to the existence of this system of dental education which we have organized and carried forward with such marvelous success and with such wonderful results. Nothing else compares with it. Take the profession as it stood a quarter of a century ago, and see the position it occupies to-day. Compare it with any of the other specialties of medicine and where does it stand? Dentistry is a much larger specialty than any other, and it is so large that it is impossible to incorporate it into a body that is only a little larger than itself. The consequence of such an attempt would be that we would sink in the estimation of the people and in our own self-respect, and we would retard the progress of dental education by any such step at this time. The time may come when such a step would be proper, and when it does I would advocate it. Take to-day the relative standard of acquirements between the graduates of dental schools and those of medical schools, and we will find that dental colleges

are more particular as to the previous acquirements of their students than are medical colleges, therefore in that regard we are in advance of them at this time. If, therefore, we allow ourselves to be swallowed up in medicine, we shall go down in that regard. And when you come to the qualifications for graduation, the same remark applies. The dental students that are graduated from the colleges in this country to-day average higher in medical as well as dental acquirements than do the medical students. The legitimate consequence and inevitable result of connection with medical schools will be precisely what our friend Dr. Fillebrown has pictured, viz, the abolition of dentistry as a distinct profession. The medical will entirely absorb the dental profession. Dentistry will cease to exist as a distinct profession. If that comes about, what else follows? If our schools are to be fused with medical schools, does it not follow as a legitimate consequence that all our institutions must fuse in the same way? Does it not follow that our organizations, our societies, must fuse in the medical societies? Does it not also follow that our national bodies must fuse with the medical national bodies? We are too large for this. All the other specialties do that, we know, but they are smaller. I believe that we are old enough and large enough to walk alone.

Dr. M'QUILLEN: The arguments presented in favor of a thorough medical education on the part of dental students are plausible. The question is, whether the system proposed is practicable or not for the mass of students, and will prepare them for the practice of dentistry. One of the gentlemen said, "It is a pity dental colleges were established, and now stand in the way of dental departments in connection with medical colleges." No one familiar with the history of dental education would have made such a remark. It is rather a pity that the prejudices of medical faculties stood in the way of establishing such departments long ago. Many years ago, before dental colleges were thought of, overtures were made to the medical colleges by leading members of the dental profession to enlarge the curriculum of study so as to embrace at least two chairs to be devoted to teaching dentistry, and a most excellent paper was published on the subject at that time by Dr. E. B. Gardett, of Philadelphia, but the trustees and faculties opposed the innovation, and the dental colleges came into existence as a *necessity*. Subsequent to this a resolution was adopt-

ed by the American Medical Association (in 1852) "That colleges of dentistry are not recognized by this association as among the bodies authorized to send delegates to its meetings," notwithstanding the fact that the delegates who presented these credentials were men of culture, leading positions, and *regular graduates of reputable medical colleges.* Thus denied an opportunity for education in the medical colleges, and the recognition of medically educated delegates from the faculties of dental colleges by the National Medical Association, there was but one course open for the education of those who desired to enter the ranks of the profession, and that was in the dental colleges. This work has been done in a manner that commands the respect of thoughtful men at home and abroad, and attracts students from every quarter of the globe to our dental colleges. Many of these are medical graduates of the universities of Europe, and they reverse the course pursued by the young medical graduates of America, who go to Europe to complete their education in the universities from which our students come. At the Centennial Exhibition it was admitted without question, by foreign judges and visitors, that the American machinery exhibited far surpassed everything presented from abroad. This was due to the fact that in developing the resources of a new country, our necessities have made an unceasing demand upon the ingenuity of the people, and have induced large numbers of men with acute intellects to devote their attention to the invention of new and the improvement of old machinery. The same influences have given to American dentistry the advanced position it occupies in the estimation of the world. There is a general impression that the teeth are worse here than in Europe. Whether this is so or not is a matter of question, but there is no doubt of the fact that from the highest to the lowest there is a more general recognition of the value of the teeth, and a greater care and interest felt in their preservation here than elsewhere. This has given occupation to, and developed the skill and stimulated the inventive faculties of, many active minds engaged in the preservation of the natural organs, and the construction of artificial substitutes. After many long years of hard work, self-sacrifice and anxious waiting on the part of those engaged in the struggle, the success attending the dental colleges has attracted the attention of the trustees and faculties of the medical colleges, and some of them have decided

to grant the boon denied before, and establish chairs from which dentistry may be taught. Is this due to a more lively interest in the welfare and advancement of our profession? If so, it comes after a very long probation with the work done by other hands. Whatever the motives or objects may be, the important and vital question to the profession and the dental student is, will *better* opportunities be presented there than in the dental colleges for becoming qualified for engaging in the *practice of dentistry?* This the future must determine. To be consistent and prove really in earnest, however, institutions that advocate a higher standard of education, and demand of medical students three years of study and attendance upon three winter courses of lectures, should require the same of dental students as Harvard Dental School does.

Dr. INGERSOLL: I am well aware that in the constitution of this society dentistry is regarded as a specialty of medicine. That term is used also in the reports. I have heard it over and over again. The term medicine is ambiguous. It has a double meaning, and can only be understood by an explanation of the meaning which is intended, whether it shall be understood in its technical or in its popular sense. If by medicine is meant all that pertains to the human organism, I will admit that dentistry is a specialty of medicine. But the term medicine as popularly understood, as interpreted in the curriculum of our medical colleges, by the medical faculties, and in the medical organizations that exist throughout the country, does not embrace dentistry as a specialty. Turn over the books of medicine — how many pages do you find devoted to the teeth? Is there anything in the curriculum of a medical college upon which you can base the practice of dentistry? Is there any medical man who has ever graduated from a medical college who could be considered, in any sense, qualified to enter upon the practice of dentistry? He *is* considered qualified to enter immediately upon the practice of the other specialties, but in no sense is he considered qualified to enter upon the practice of dentistry. Why? Because the former are regarded by the medical profession as specialties of medicine, and because the latter is not regarded by the medical profession, or in medical literature, as a specialty of medicine. I am for maintaining the dental profession distinct from the medical. I am for independence, whether we live or die, sink or swim; for the reason that

we have risen to our present position by independence. The dental profession is *not* an outgrowth of the medical profession,—is not a child of medicine, as popularly understood.

Dr. JOHN ALLEN: To show that we have the entire confidence of the medical profession, let us bring the matter home to ourselves. Medical men have occasion to have dental operations performed, as well as other folks. They come to us with the most perfect confidence, that when we tell them this, that or the other must be done, they yield at once. We never have any discussions on the subject with our medical brethren. They come with the utmost confidence in us, that what is right we will do, and consequently they give themselves entirely up to our care, and when they have cases, (and they do occur again and again in our larger cities,) where they are at a loss to know what to do, if disease is connected with the head, jaw or face, they at once yield to the better judgment of our dental practitioners.

Dr. CROUSE: This resolution is, to add a dental department to medical colleges. We are fighting against such a measure in Chicago, and have been for years, to keep the medical schools from adopting a dental department, and forcing upon us a dental college which the profession does not need. The same movement is going on in Iowa. There are men in both the dental and medical professions that are trying to establish one-horse dental colleges. We have enough of these already, and I think the expression of the association that we do not want any more medical schools to add dental departments to their institutions unless they make a complete course obligatory, would have a good effect on such medical schools.

REPORT OF COMMITTEE

ON

THERAPEUTICS.

By FRANK M. ODELL, Chairman.

ALL departments of medicine, and of each of its divisions, have a disposition so strongly marked, to glide into each other, that to sharply draw the separating line is often a merely arbitrary measure. Just where normal histogenetic and histolytic actions cease, and inflammatory action begins, is a point as yet too fine for pronouncement. In like manner the exact dividing line between the inception of the acceleration of reparative or inflammatory action, and the corporeal state nominated "fever" is often very misty; but so close is their relationship that it is not too much to say that every interference with the regular ebb and flow of the various nutrient currents is productive of a somatic or local condition simulating or directly resulting in a more or less pronounced feverish manifestation.

So long as the regular processes of nutrition proceed in rhythmical order, the temperature of the body remains at a point most conducive to its functional integrity; but the slightest interference, whether from clogging of the various debouchures of the body, or from obstruction of function of organs deeper seated, induces such a struggle for resumption of the normal interchanges as to immediately call forth potential energy sufficient to restore the equilibrium.

Every such systemic exhibition of intensified force (nominated *vis medicatrix naturæ*) being an increase in the rapidity of molecular interchanges (always productive of development of heat), immediately causes a rise of temperature in the locality where the acceleration of action takes place; and this thermic elevation is ordinarily immediately compensated through the various *media* by heat dissipation.

Any obstruction to this heat dissipation, whether local or somatic, tends to induce fever; hence these pyretic conditions are the most frequent morbid states falling under medical observation, and possess a most powerful attraction to the medical mind.

A bodily temperature of 98.5°–101.5° Fahrenheit, what is termed feverishness, very often obtains in the cases of children, without necessarily implying danger; and yet a very slight elevation above this point indicates serious complication, and at 107°–108.5° Fahrenheit, the poor body has attained a febrile altitude at which existence is possible for only a brief period, and recovery hardly to be thought of.

At the normal temperature of the body oxygenation of muscular tissue goes on very slowly; but with a sustained high temperature the blood-current becomes *filled* with débris of nitrogenized tissues; and the rapid wasting away of the sarcous elements during high fevers is one of the most astonishing manifestations with which the medical mind is familiar, and one which to the *patient* seems the most disgustingly unnecessary; their sudden loss of muscular power being always the, to them, most unaccountable.

This bodily state (muscular weakness and sustained high temperature) indicates the typhoid condition; not necessarily typhoid fever or typhus fever, which are the result evidently of a specific poison, but a condition calling for great conservation of the powers of nutrition nevertheless, and indicative of the mode of treatment to be pursued, not only in this but in every case so far as temperature is concerned.

Increase of bodily temperature must obviously result from one of three sources, viz: (1) Augmentation of heat-production; (2) diminution of heat-dissipation, or (3) a combination of increased production and impaired dissipation of heat.

Now what I wish to impress upon you at this time is *doubtless* just what you have always known, and in a measure practiced, but perhaps I can throw a little more light upon the *reasons* for that practice, and so make it more consonant with the indications which in each case present, and more generally and speedily successful; and in order that you may the better comprehend the therapeusis, I beg leave to lay before you the basis upon which the treatment is built.

Biolychnion (from the Gr. βιος 'life,' and λυχνιον 'a lamp,' ani-

mal heat or vital heat,) is that temperature of the body which in the normal or healthy condition is always maintained (clothing of course being a conservating factor) regardless of the temperature of the surrounding atmosphere.

This normal temperature is marked by Fahrenheit's thermometer at 97.5°–98.4°.

Within this slight range of temperature is health.

A rise or fall of one degree is temporarily induced by ingestion of food, by exertion, by stimulation, or other slight causes, but any depression below 97.3°, or any elevation above 99.5° Fahrenheit, is, if *persistent*, a sure indication of disease.

These facts, collated from a very large range of hospital practice, prove beyond doubt the value of the thermometer as an auxiliary of the first magnitude in diagnosis.

Indeed, Dr. Alfred L. Loomis, of New York city, a physician of remarkably extensive experience, speaks of thermometrical observations as follows:

1st. An abnormal temperature determines the presence of some disturbance in the animal economy.

2d. Thermometrical observations aid us in discovering the *laws* which regulate the course of certain diseases.

3d. When the normal thermometrical course of a disease has been determined, its diagnosis is simplified.

4th. The thermometer indicates quickly and certainly any deviation in the course of many diseases (meaning those whose course *has* been determined), the transition from one stage to another, and the commencement of convalescence.

5th. It reveals the occurrence of complications.

6th. The height of the temperature decides the severity and danger of a disease.

7th. It often reveals the imminence of a fatal termination.

8th. It sometimes shows the impossibility of the continuance of life.

9th. It is an important guide as regards the effects of remedial agents.

10th. Certain degrees of temperature indicate fever.

The maintenance of this point of biolychnion, which is of course in a state of constant oscillation, is due to a variety of inciting circumstances, the study of which, with the proper appreciation of the

signification of each, gives us the key to all treatment having for its object the control or direction of these processes; and the measure of our ability in practice depends entirely upon our regular apprehension of these phenomena.

Movements among masses, molecules or atoms, whether of construction, aggregation or destruction (or separation, elimination and extrusion), result in the evolution of heat. By a natural inference we apprehend that from the time of prehension of ingesta, through all its changes of location, in insalivation, deglutition, digestion (which comprehends manifold combinations and separations, both mechanical and vito-chemical, including chymification, chylification and absorption), to assimilation which implies nutrition and oxygenation, oxidation and disintegration which involve resorption of hystolytic elements into the circulation, and transportation to the various somatic emunctories, where, by the selective power of the epithelial elements constituting the glandular apparatus charged with these functions, until secretion and excretion close the circuit, all of which movements include polarization and depolarization, heat is freely evolved, which, being the result of the combined action of ALL the molecules, would serve to maintain the temperature far above the point compatible with corporal integrity, were it not for most wonderful provisions for heat dissipation, which by *counter* action serve to maintain the happy norm wherein lies safety to the organism.

By a little reflection, you will perceive that in the above correlation is implied, if not expressed, all the known processes whereby not only the *immediate* wants of the system are supplied, but provision for a steady and unintermitting supply of heat effected.

It is not necessary for me to go into a categorical enumeration of the processes for storage of glycogen in the liver, and liberation of hydrocarbons from sarcous and adipose tissues; but I will at once proceed to a consideration of the provision made for heat dispersion, which in our treatment for fevers is a vital point for medical consideration.

Heat dissipation is effected normally and principally by the skin, and to a considerable extent by the respiratory tract. Circulation of the blood in the cutaneous vessels and in the pulmonary capillaries results in considerable radiation of heat into the atmosphere: free blood-supply rouses the sudoriparous glands to action,

and by evaporation of the product of their functional activity very considerable heat-dissipation follows. Dilatation of the cutaneous vessels, permitting a great flow of blood therein, results in increased radiation of heat, and contraction of the internal capillaries in decreased heat-production.

Cold drinks reduce temperature by direct abstraction of heat, and perhaps by direct addition of the principle of cold.

Warm drinks, which at first raise the temperature, if continued until the action of the sudoriparous glands is accelerated, will afterward depress it in consequence of increased transpiration.

Massage (from the Gr. *μασσω*, to knead), being the manipulation practiced by professional rubbers, or magnetists, and at the Turkish bath, is another most excellent mode of reducing excessive heat-production, and promoting heat dispersion, or *vice versa*, according to the requirements of the system, on the principle of restoring tonicity, whereby the organism is enabled to resume control of the functioning activities.

To make this proposition more apparent to the minds of those who have had no responsible experience in this direction, I might be pardoned for referring to the treatment which your essayist adopted when suffering from that, to most minds, alarming exanthematous visitation (I purposely avoid the term "affliction"), small-pox.

Before the formation of any blebs, and after two days of racking pain in every muscle, and apparently in every bone, together with a feeling of tendency to delirium, as evidenced by cephalalgia of a dull, unendurable variety, accompanied by great elevation of temperature, the headache being quite evidently due to circulation of detritus of sarcous elements in the blood-current, as well as to the thermic elevation, thorough ablution with warm water and soap, preparatory to the religious duty of "massage," which under my direction was efficiently performed by a faithful and anxious wife, and followed by another washing with warm solution of pure spirits (commercial crude alcohol), as a cutaneous stimulant, resulted in immediate relief from all the distressing symptoms, together with a plentiful crop of cuticular elevations, which made their appearance within the ensuing six hours. The treatment had been addressed simply to the reduction of temperature, and the result which immediately followed, due doubtless to profuse dia-

phoresis, by the determination of the fluid constituents of the lacunar and vascular areas of the body to its cutaneous surface, whereby the glands took on an intense vicarious action, resulting in the plentiful production of blebs, and their gradual attraction of the histolytic products of the febrile action, which by relieving the other emunctories of the congestive crowding of toxic-egesta, and by consequence of the necessity for excessive action, naturally resulted in resumption of normal functional oscillations of endosmose and exosmose, secretion and excretion.

The subsequent treatment of this exanthematous fever consisted in the careful surgical evacuation of each bleb, when filled, of its contents, so as on the one hand to avoid the action of the escaping escharotic fluid upon the adjoining healthy cuticle, which is readily accomplished by means of minute pieces of paper applied to the margin of each bleb as opened, until no more fluid extrudes, and on the other hand, to avoid pressure upon the blebs, the deep extremity of which, resting upon the highly sensitive papillæ of the true skin, would under pressure from rubbing or otherwise wound the same, and produce scar-tissue where there would otherwise be no mark remaining.

Subsequently the surfaces of the blebs should be kept constantly bathed in some emollient, as glycerine and water, or vaseline, which relieves the superficial epithelial scales of their stiffness, and constant *consequent* inclination to augment the systemic inflammation by epidermical irritation.

By avoiding nitrogenous food, and persisting in the employment of the most perfect sanitary regulations, and avoiding all excitement, the latter stage of the treatment becomes a mere exercise of patience, abstinence, and avoidance of thermal variations, neglect of which precautions might protract convalescence.

Covering the face with something to exclude the atmosphere, as a *mask* of dough, has been much practiced in this connection; but the weight and points of attachment of the mask frequently *cause* the very scarring which it is designed to prevent.

During the progress of the fever, cooling ingesta, such as apples, tea without milk or sugar, and stewed fruits, are in order, and act kindly, being likewise very grateful to the palate; much of the cooling properties of such food being due, I have no doubt, to the influence of the action of color,—the blues and the purples.

For a novel and philosophical exposition of the influence of color upon all natural processes, I refer you to a very beautiful work just published, entitled "Principles of Light and Color," by E. D. Babbitt, D.M.

With your permission, I will again refer to the clinical thermometer; in order to a complete outline of the method of using which for diagnostic purposes, it must ever be borne in mind that a single thermometrical observation is an important element in diagnosis only when taken in connection with other physical signs. The pulse and number of respirations should always be noted at the same time. *Frequent* observations should be taken at regular diurnal and nocturnal intervals, so as to note the *rate of variation*, as well as the mere *fact* of variation.

These observations should be made at any point of the body where the instrument can be entirely enveloped by the tissues, the mouth being in this connection, as in history or narrative, the least reliable.

In the analysis of histolytic products, we have in the single item of renal excretion urea (so long as no renal complications exist) a guide to the biothermal condition of the patient, quite equal in accuracy to the thermometer; the excess of excretion of urea above the normal elimination (which in different individuals ranges from four hundred to five hundred grains daily) marks the severity of the fever, or the intensity of the interchanges induced by this morbific presence.

In the direction of apyretic agents, our materia medica *overflows* with diaphoretics, depressants, various methods of applying cold, and the more scientific methods of acting upon the circulation, and through *it* reducing the pyresis.

Some remedial measures are addressed to decrement of heat-production, others to increment of heat-dispersion, while others depend upon the cooling effects of increased transpiration. Even bleeding and leeching are excellent means of reducing or diverting inflammations threatening congestions or fevers.

Acids, both mineral and vegetable, present efficient defervescent agents, and citric acid is almost specific in scurvy.

Fresh air and sour wine have, single handed, coped successfully with the fever fiend.

Dilute phosphoric acid, aromatic sulphuric acid, and hydro-

chloric acid, are agents in high favor with many practitioners. Acetate of ammonia is a favorite remedy, especially for children.

Those diaphoretics which are at the same time depressants, as ipecacuanha and tartar emetic, are exceedingly effective; but aconite, in its action in controlling inflammation and concurrent fever, is one of our most wonderful and reliable remedies; it should be administered in the early stages of the pyrexiæ, half a drop to a drop of the tincture of the root in a teaspoonful of water every ten minutes for two hours, and afterward hourly.

Chloral hydrate, which is in high favor with many, does not enjoy my confidence to the same degree, because, acting by paralysis of the nerve-centers, it is apt to astonish the patients by their translation into the next higher sphere.

Such measures as have been indicated are proper in cases where the temperature is sustained in consequence of defective heat-dissipation where restoration of dermal function is sought; but in many fevers we have a plentiful transpiration accompanied by increasing temperature. Such a case I had last summer, where while talking with the patient, who, though very weak and anxious, was still able to be about house and attend to her duties, the water would actually drip from the arms and head. Here we had plentiful provision for superficial heat-dissipation, but increase of heat-production to an alarming extent nevertheless. This was a case directly induced by a combination of irregular and inappropriate food, frequently omitted altogether through disgust at the surrounding filth, malarial emanations from garbage stored in most unlikely places, and elevated atmospheric temperature, with slight constipation.

My first blow was struck in this latter direction by a cathartic, followed next morning by a draught of citrate of magnesia and large draughts of cold water. This treatment was immediately supplemented by my sheet anchor in such cases, quiniæ sulph., administered in large doses until cinchonism is produced; in this case requiring only sixty grains, administered in one dose of thirty grains and three doses of ten grains each, and all within twelve or fourteen hours.

In a case of parturition I have likewise administered quinia with marked benefit to the patient, reducing the temperature from 102° Fahrenheit to 99° within two hours.

In some cases quinia seems to be rejected by the absorbent vessels. In such instances administration in milk or soup will often promote its ready assimilation; but where it is absolutely rejected, as after long use it sometimes is, or where it is productive of unpleasant symptoms before accomplishing the object sought, it can frequently be substituted by salicylic acid, which is apt to meet in such instances with a kindly reception, and which in drachm doses produces a decided thermic depression. A combination of salicylic acid with quinia also acts charmingly.

But in the proper regulation of bathing appliances, with an intelligent use of the thermometer, which includes consideration of the causes of the pyrexia, and the consequent best manner of combating it, I place quite as much reliance as upon medication.

And we are now approaching an era when the proper use or direction of the so-called "finer forces," together with a study of the influence of light and color, bid fair to, in great measure, usurp the field now occupied by the more ponderable therapeutic agents.

Thanking you for your kind attention, I beg to apologize for the length of the paper by explaining that, owing to a pressure of duties, I had not time to make it shorter.

DISCUSSIONS.

Dr. SPALDING: I wish to say, in regard to the able paper which has just been read, that it contains so many details that it is impracticable to discuss all its points at this time. It is well known to many of you that my therapeutical views do not agree with those contained in that paper, and therefore, in a spirit of kindness, of investigation, and of a search for the truth, I shall hold it my duty to review that paper to a considerable extent after it appears in print. All I want to do at this time is to call attention to one important therapeutical agent in cases of exaltation of temperature, that we commonly denominate fevers, which the writer omitted to mention, probably because his attention has not been called to it. I refer to *Gelseminum sempervirens* (the common yellow jasmine) as being superior to aconite or to any other remedy known to me for general administration in fevers. It should be given in one or two drop doses of the tincture, and may be given with a frequency in accordance with the severity of the case. If the

case is severe, the administration of the dose may be repeated as often as every ten or fifteen minutes, extending the period of administration to two or three hours as the symptoms subside. Where the inflammatory symptoms are general, this remedy is, in my estimation, far superior to any other that has ever come to my knowledge. For local inflammations aconite is its superior.

Dr. FLAGG: I have found aconite to be my best antiphlogistic. I have experimented with jasmine for many years, and although it is in some instances an excellent remedy where aconite fails, I have nevertheless found it a very ticklish medicament. It comes under the category of hydrate of chloral, and oftentimes it will trip you up, and I advise that one should be well prepared before he prescribes such medicines. I cordially indorse the practice of the gentleman who read the paper, and would add that if I were very sick and likely to die, I would not object to having him take care of me.

Dr. ATKINSON: This paper is a congeries of correlated truths, the result of long and honest experience, but has it touched a principle,— has it led us one step beyond empyricism? Do we know anything about the how and the why of the results that follow the administrations of remedies that have been so magnificently presented to us this morning? Until we *know*, we are under the ban of generalization, and lost in clouds of ideas without the differentiation and specification of the modes of motion that are involved in the manifestation of the symptoms that we observe. There appears in the report this statement — "that when the system gets control of the functions—" I don't think the writer meant to say that. The system is itself the result of functional action in that peculiar process that constructs it for specific purposes; and it is only so far as to the appetency to receive the modes of motion that operate the functions of the body that the system can be said to have anything to do with the activities within it at all. This brings us to the point that constitutes the derangements presented so beautifully. How is it that the agents administered have been observed to lessen or exalt the temperature of the body? How do they thus present these favorable or unfavorable manifestations? I will not go through the whole catalogue of names of the groups of remedies that have sometimes been polypharmic (made up of many constituents) and called one remedy in therapeutics, or to

show how in even dual agents the action upon the functions is manifest. What is tonicity? We say we give tonics, and we give sedatives. What is tonicity and what is sedative action? We must discriminate a little more closely if we are ever going to attain the ability to comprehend therapeutics, and be masters of the situation. Tonicity means the bringing about the tone of the vessel, or the muscle in the vessel,— for to say the vessel I am contradicting myself and am doing as I said before,— merely babbling, because of the bad habit adopted from my false teachers. Tonicity is the tension of vaso-motor nerve. One of the differentiations of the nervous system is the vaso-motor twigs, in which the neural current within the system acts upon the protoplasm of the muscular fibres, constituting tonicity.

Therapeutics has been defined. I shall call your attention to what therapeutical action is. We are dealing with the kind of functional action that is induced by restoration of lost balances in the machinery of the modes of motion that we call function, so that therapeutical action is the reëstablishing of the normal activity, and the therapeutical agent is that agent which is brought into such relationship with the organization as to operate upon it in three ways. One has already been indicated by that of tonicity, which is the making up of the tissual elements by the synthesis which constitutes the elements of the tissues in molecular mass, and that is why globulin (or whatever you please to call it — the complicated salt of iron that gives the red-blood corpuscles their color) enables the molecular mass to receive and appropriate the modes of motion that are combinatory of its mass, and even of the atomic constituents of the same. Therapeutics, then, is the proper feeding of the organization by which the needed pabulum can be brought to bear upon the constituency of the elements of the tissues, the globules. There are two other points of movement still to be considered; one is that which will offend and depolarize, and shut up all these channels, so that there shall be no further appropriation of the ferric salts. The next point is, there is such a kind of therapeutics as is adventitious,— that stimulates adjoining healthy territories to so operate as to have an excess of their energy to supply all the weakened territory.

Has not that simple idea often been covered up in all our past instruction in medical literature?

What is fever, and how many kinds are there? There cannot possibly be but one kind, and all the differentiations of that are but degrees of demoniac possession, constituting the so-called varieties of fever. They talk about intermittent fevers, and typhoid fevers, and sthenic fevers. *Sthenic* fevers! Heaven deliver us! Sthenic weakness; is not that bad — strong weakness! And they say asthenic, just as if any diseased action could be anything else than asthenic. Chemists know that. The point is that we have acids and alkalies. We reduce all our food elements to acids or alkalies. Acids operate so as to neutralize alkalinity, and the alkalies to neutralize acidity, so that when from any overwork, or the inception of any poisonous substance admitted into the circulation, the territories set up combustion, and there being not enough of the combustible material (hydro-carbons) in the flesh of the part to satisfy the desire of the oxygen to constitute a complete combustion, it seizes upon the elements in the organized tissue; in other words, it seizes upon the nitrogenous elements in the muscular and albuminoid tissues, and that gives you fevers. Now do you know why acids cure fevers? Because the acids supply the necessary elements to have the combustion go on in the fireplace, and not outside of the fireplace and in the house. You know there are three alkalies necessary in the human body — potash alkali, soda alkali and the ammonia alkali. When they are acted upon too much by acids you get what are called typhoid fevers; and when I say acted upon too much, what do I mean? I mean that when there is not enough oxidized material in the circulating system, intra-vascular, extra-vascular and extra-corpuscular tissue lying within the interspaces of what we used to call inter-cellular spaces, then the oxygen seizes upon the oxidizable element of the tissue and produces the mischief. Now do you know why some drunkards do not die early? Do you know why gourmands live as long as they do? Because they have stuffed themselves with combinations of hydro-carbon to such an extent as to satisfy the demands of all the oxygen they take in when they breathe so very liberally, and thus the tissues escape being operated upon.

REPORT OF COMMITTEE

ON

DENTAL LITERATURE.

By C. D. COOK, Chairman.

DURING the year which has passed since the last meeting of this Association several works pertaining to the dental specialty have appeared, as well as some new ventures in dental periodical literature. Of the dental works, four are in the English language, one being American.

The American work just referred to, although, perhaps, not worthy of so high-sounding an appellation, is yet, in its aim, of considerable value. It is a small pamphlet for popular instruction, entitled, "Our Teeth," published by the Illinois State Dental Society. This little work is intended for gratuitous distribution to the public, and aims to give such practical information concerning the teeth as may induce the best results from personal care and attention. While it does not, of course, teach everything concerning the teeth, or define or detail all dental affections, there is sufficient information in its pages to enable any intelligent person to know that there are various causes for dental disturbance which are amenable to skillful treatment, and to indicate to him when it is important that he should seek professional advice. The work is clearly and concisely written, in a style not too familiar, while, also, not excessively professional. Such a work will, it is believed, be productive of much good.

"A Treatise upon the Anomalies of the Dental System in the Human and Other Mammalia," by Dr. E. Magitot, edited by G. Masson, Paris, 1877, has been published in the French language, and is a valuable acquisition to our scientific literature. It is a quarto volume of over 300 pages, twenty of which are given to illustrations of the text, each page containing from eight to twenty-

five fine engravings, most of which are designed from nature. The work is the result of ten years of patient and minute research, and has been deservedly "crowned by the Institute of France." It is the first publication embracing the whole field of dental anomalies which has yet appeared.

In introducing his subject the author discusses, under the heading "Generalities," the general aspects of dental anomalies, and furnishes their statistics and classification. He then presents them successively in the vertebrates, the lower mammals and the human races. Here the work touches upon some important and recent questions in the domain of anatomy and physiology (anthropology) in fixing the laws of *number* and of *situation* of the dental organs, and their morphology, and at the same time considers the "phenomena of reversion," or return to the original type. Another paragraph treats of the *mechanism* of the formation of anomalies, viz., *special teratogeny*. This chapter closes with showing the connections which the different deviations present, together with the production of the lesions, either medical or surgical, which arise in consequence.

Dr. Magitot divides his subject into nine classes. Of these we will consider, first, the chapter commencing with the anomalies of *number* in man and the domestic animals. Then follow the deviations from the normal position, or *heterotopia*, and all their pathological consequences, of which some very curious and interesting examples are given.

In his treatment of the teratology of the dental system, the author borrows much useful information from the collateral sciences, while he lends to them many valuable facts and applications. To the zoologist and naturalist he presents the form, number and direction of the dental organs, and shows that these are obedient to the special laws of evolution in the successions of beings. He indicates the morphological modifications, from which the simple tooth of the inferior vertebrates is elevated and developed, by degrees, to the complexity and perfection which these organs present in the superior animals. He illustrates, in fact, the doctrine of primitive type,—of dental unity.

In this scientific and complete exposition of dental anomalies the author has succeeded in bridging a broad chasm hitherto existing in our literature. Instead of accepting the teratological classi-

fication of Isidore Geoffrey Saint-Hilaire (who was guided by the principles before adopted by his father, and which may be called the "anatomical method"), Dr. Magitot has adopted what he styles the "physiological method," and has described dental anomalies under the following heads: 1st, Anomalies of *genesis*, which include the deviations in *position* and *number*. 2d, Anomalies of *nutrition*, including those of *form*, *size* and *structure*, and the aberrations in the intra-follicular life of these organs, which produce the odontomes and the cysts. 3d, Anomalies of *development*, which comprehend the diseases in the eruptive stage, and the reciprocal direction and disposition of the teeth.

In Section II, under the head of "Anomalies of the Dental System in the Mammalian Series," the author says: "The dental system considered in the mammalian class manifestly presents, in all its characteristics, a certain *fixedness*, which decreases sensibly as soon as they descend in the scale of vertebrates. The *cone*, more or less sharp, is the rudimentary primitive form of the dental system — the primordial type — the unity or archetype — upon which seems to be constituted the ascendant series of the morphological modifications of the dental system." "It is," he says, "what we call *the conoid type*, toward which we observe the tendencies to revert on the part of the superior forms which are struck with teratological aberrations."

This view is supported by a close analysis of the teeth of various fishes, reptiles and animals, including those of the monkey and of man, and in comparing these the author sustains his opinion by giving the histological origin of the various structures composing the teeth, and their similarity of origin with the hair, nails, etc.

The next section is devoted to the anomalies of the human denture,— noting the changes observed in the different races and in different epochs.

The fourth section is headed "Teratogeny of Dental Anomalies," and treats of the many causes which may interfere with the normal genesis and development of the teeth, to produce a modification of form, etc. The comparative teratology of animals, fishes and man is shown. Here the author briefly explains the origin of the enamel-organ,— not alone of the normal number of teeth, but of the supernumeraries (adopting the theory of Kollman as to the genesis of the latter), and notices the more or less mod-

ified forms which these anomalies assume, and their sometime tendency to return to the fundamental, primitive or *conoid* type.

The third section in chapter 2 is devoted to *augmentation in number*, with tabular illustrations.

We have given a hasty synopsis of the contents of only a third of the work of Dr. Magitot, but even so little is sufficient to indicate the very great value of this treatise. Indeed, it is a work of such magnitude and scope, treating dental anomalies, as it does, from physiological, pathological and surgical standpoints, that we must confess our inability to do it adequate justice in this writing. That it is far in advance of anything which has preceded it upon this subject cannot, we think, be denied; and while it may not particularly aid the skilled American dentist in his practical treatment of anomalies of position and direction, yet, from the standpoint of science and theory, there are few who will be unable to derive immense benefit from its clearly-written and admirably-arranged pages. To this end, in English-speaking countries, it is to be hoped that a good translation may soon be put into our hands.

M. Valérien Pietkiewicz, of Paris, is the author of a work on "Alveolo-Dental Periostitis," also in the French language. This makes an octavo volume of two hundred pages, and is of sufficient value and rank to deserve notice. The work is evidently the result of much laborious study, but space forbids more than a résumé of its contents.

The first twenty pages are devoted to the anatomy (normal and pathological) and physiology of the periosteum, and a description of the structures composing the teeth. This is followed by about forty pages upon the "complications" incident to or resultant upon alveolo-dental periostitis.

The chapters upon Etiology, Diagnostics, and Treatment, occupy over one hundred pages, and these subjects are treated methodically and with great minuteness of detail, and also, we may add, with considerable ability.

Part 2d of the work, which constitutes its remainder, is given up to what the author styles "Observations"—a summary of cases mostly selected from journalistic, hospital and private reports. Seventy-two cases of periostitis and associate diseases are very minutely detailed,—the age, sex and temperament of the patient, with the treatment, progressive stages of the disease, and results, being given.

While we cannot recommend this work as a *practical* guide to the dentist, we believe it to be, especially from a scientific standpoint, of considerable merit.

Next comes the memoir of Drs. Legros and Magitot on the "Origin and Formation of the Dental Follicle in the Human and Other Mammalia," also in French.

This memoir is of so important a character, containing, as we believe it does, the latest reliable researches into the early development of the teeth, that although it was written five years ago, we deem it proper to notice it briefly even at this late date.

It commences with the first trace of the dental germs in the human embryo and in the different species of mammals, and illustrates the progressive stages of development of the dental tissues up to the time when calcification commences in the enamel and dentinal pulps; hence it embraces that period in fœtal life commencing near the forty-fifth day and extending to about the seventeenth week,— a period of about twelve weeks.

This treatise is peculiarly valuable because it presents the subject so clearly and minutely that no one can fail to obtain a full and perspicuous view of the dental beginnings, and especially because it embraces that period in dental evolution which is surrounded by the greatest histological and physiological difficulties, which have not hitherto been presented in a clear and satisfactory manner in any language.

We are glad to state that the work has recently been translated into English, with a view to its publication, and that to the translation have been added copious notes, designed to make the subject-matter more easily understood by those not fully conversant with dental histology. Judging from the pages of this translation which we have seen, we believe this work will fill a gap in the literature of our profession which should not have existed at this time.

Dr. Alfred Hill, of London, has published in that city a work entitled "The History of the Reform Movement in Great Britain During the Last Twenty Years." This work is of great value to the student of professional politics, as well as to all who are interested in the growth and causes of advancement of general dentistry. To make any extended review of it, however, would carry this report outside its proper province, hence such will not be attempt-

ed. To speak plainly, the political aspect of professional life is one which, as we believe, has already entered too largely into our professional work and relations, and we should be glad to hear less of discussion on ethical and economical principles, and a more extended and clearer view taken of the real necessities of the profession, as such. It is well to have books, periodicals, societies and colleges; but it is better, having these, to scrutinize, criticise and guide them toward professional excellence, rather than to allow them to drift toward personal aggrandizement.

"Practical Observations on the Degeneracy and Preservation of the Teeth" is the title of a small book intended for popular reading, of which Edwin Cox, L.D.S., of London, is the author. From the scientific and ethical points of view this work ranks very much higher than the ordinary popular dental treatise. In fact, it will be found of great value to the dental practitioner at large, as well as to his patients, and is recommended to such as containing not only many old ideas, which most of us had almost forgotten, but statistical and selected information and ideas new to many professional men. The following extract is from the preface: "True, they (dental diseases) are not infectious, like zymotic maladies, but, like them, they originate in faulty hygienic surroundings and violations of natural law, and their arrest and removal cannot be accomplished to any adequate extent by professional and direct treatment alone, however skillful and thoughtful, but demand the observance of general sanitary laws, the study of dietetic and medical principles, the adoption of preventive and anticipatory treatment, the avoidance of confessedly bad habits and irrational customs,—in short, a return to that course of life which best conduces to the healthy and harmonious development of the physical and mental powers." This is the key-note to the conclusions of the writer in the body of the work. To prove these propositions he amasses a considerable quantity of respectable and valuable evidence.

The writer holds, as the predisposing causes of caries, 1st, Systemic disturbance; 2d, Hereditary defect and predisposition to decay; 3d, Influence of climate and soil, and 4th, The sympathy which everywhere prevails between the dental condition of a nation and its habits and modes of life. This latter proposition he elaborates into seven chapters (Part 2 of the book), starting with

the statement that "Sympathy between the dental condition of a nation and its habits and modes of life may be regarded as a general law more or less visible throughout the history of ancient and modern races, and its most familiar evidence lies in the fact that in proportion as simplicity of tastes and the conditions of health are forsaken, and life becomes artificial, sedentary and intensive, dental disease obtains and extends." In illustration of this fact, he gives two chapters to dietetic errors, and one each to alcoholism, nicotinism, want of cleanliness, and syphilis, summing up his views as follows:

"Dental deterioration results from neglect or violation of the natural laws of health. If it were possible to find a people who for generations had obeyed these laws, among such dental disease would be unknown. The teeth were designed to render a life-long service, and the agony of extraction is the protest, and, in part, the penalty, by which Nature condemns the disobedience involving their removal. In greater or less degree this disobedience is common to all people, and, as a consequence, a proportionate infliction of dental disease. The most familiar forms of such disobedience, and the most potent for evil, are those unwise dietetic and social habits and vices (to which we have referred) producing general physical enfeeblement and depression of vitality, a morbid — that is to say, an acid — state of the blood, and a corresponding acidity of the secretions of the mouth; and in the growing influence of such vices and evil practices, and wrong dietetics, and want of due cleanliness, we find the chief causes of dental degeneracy."

The third and last division of the work contains a chapter on "Habits and Hygiene," in which the writer favors the "fruit and farinaceous" over the "flesh" diet, a chapter on the care of the teeth in childhood, and one on "conservative dentistry" in youth.

We have been thus full in our treatment of this little book because of our conviction that its principles, although in the main tolerably well known, are not heeded as they should be by the mass of professional men. How many of us are there who so far strike at the basis of possibility of a dental profession as to systematically and continuously endeavor to prevent dental disease by systemic hygienic treatment? Who warns his lady-patients of the pernicious effects of the ordinary evils incident to modern female life, as want of exercise, omnivorous diet, late hours? Or his gen-

tleman-patients of the bad effects of intemperance, the use of tobacco, epicureanism, or any dissipation? Many will answer: "Such things come only within the province of the general medical practitioner." Are *we*, then, *less* than medical men? Are we healers of the sick, or are we simply tooth-fillers and replacers? And shall we aim simply to *cure*, leaving *prevention* of disease to others, or to *no* others, as the case may be? A view of dental professionalism which extends no farther than tooth-filling is only a partial one, and if universally held, cannot fail to destroy all attempts at advancing dentistry beyond the position of a mere mechanical art.

The province of materia medica in dentistry is one which, while of great practical and theoretical importance to us, is as yet hardly explored. The application of many remedies, well known in general medicine and surgery, and which, theoretically, would be expected to be of benefit in operative dental practice, has not yet been generally made. It is improper, in this place, to endeavor to trace the causes of this fact, yet the inference from history may be made that increase in the number and change in the character of remedial agents for dental disease will occur in exact ratio with the development of truths in dental pathology. This condition of scientific twilight about dental materia medica is the probable (and most obvious) cause for the scarcity of separate works on the subject, and for their comparatively insignificant character when such do appear. The brochure of Dr. J. W. White, published some years ago, was, until last year, the only work treating exclusively of the subject, so far as we are aware. But now another small work, from the pen of James Stocken, L.D.S., F.R.C.S., of London, is before us. The paucity of works on exclusively dental materia medica, in the language of the preface, "induced the medical staff of the National Dental Hospital to depute the author to compile a manual for the use of the Hospital, and he undertook the task for that particular purpose. Subsequently, however, it was urged upon him to extend its scope with a view to publication." Accordingly, after having appeared in sections in the "Monthly Review of Dental Surgery," it is now issued in the form of a duodecimo volume of one hundred and forty-seven pages.

The work commences with a few pages of definitions and tables, followed by one hundred and four pages on the main subject, and

closes with about twenty pages of formulæ. The arrangement of the matter is excellent, the remedies being placed in alphabetical order, and, in most cases, the old and new chemical formulæ, the characteristics, preparation and physiological effects and therapeutics of each remedy being given. Still the work, to an American practitioner, would seem incomplete in some particulars, and redundant (as materia medica) in others. Certain remedial agents in common use here are either ignored or very slightly treated. Oxalic acid, Monsel's solution, oxide of zinc, have no mention in the book. Creosote is treated by saying, simply, that "carbolic acid has nearly taken the place of this agent, for, though very nearly identical in their action, some advantages are claimed for the carbolic acid." Bleaching appears to be unknown in England, for this process is not mentioned, though the lime and chlorine compounds are otherwise pretty well treated. Oil of cloves is dismissed as a "popular remedy for odontalgia." Precipitated chalk is spoken of as "good for obtunding the sensitiveness of dentine." Permanganate of potash is said, when "applied in powder to a carious tooth," to "cure odontalgia." Many remedies, certainly not in common use by American dentists, are fully discussed, as croton oil, cod-liver oil, and wheat starch (for bandages). Also, it is difficult to discern how such substances as wax, litmus, gun-cotton (*not* the solution in chloroform), India rubber and vulcanite can be considered as materia medica,— at least, directly so. And finally, if gutta-percha (as a temporary filling) and mercury (as a component of amalgam) are to be held as dental materia medica, why should gold, tin and oxychloride of zinc be excluded?

In passing, it may be well to say that, in a recent American dental periodical, this work being under review, the author was reminded that the use of "quotation marks" had been neglected by him. So far as we can see, ample general credit has been given, by name, by the author, to his authorities. Further than this it would be difficult to go; for, in writing anything, should one credit *each item* of his acquired knowledge by such distinction, the vast majority of all literature would consist of "quotations," to the despair of the type-setter and the total abolition of "original" essays.

Turning, now, to periodical literature, we chronicle four new ventures in that field,— one Italian and three American. Of the

first, since we have not seen a copy, we can form no opinion, except such as may grow from the character of some extracts translated into our own journals. These would seem to show that the new journal (called "L'Odontologia") bears an excellent character for scientific literature.

Of the American journals, the first in date of appearance is the rejuvenated "Canada Journal of Dental Science." Long in abeyance, this periodical made its reappearance in August last as a quarterly, under the editorship of Dr. W. Geo. Beers, and is an independent journal, he being its sole proprietor and publisher.

The "St. Louis Dental Quarterly" is also an independent journal, its editors, Drs. C. W. Spalding and Henry S. Chase, being its proprietors as well as its conductors.

For some years past the New York Odontological Society has published its transactions through the medium of the "Dental Cosmos," but various reasons induced changes which have resulted in their quarterly appearance in the pages of the "Dental and Oral Science Magazine," edited by Mr. James E. Dexter and published by Mr. R. S. Williams.

The transactions of the Odontological Society form the main portion of the literary department. To these are added two departments of selected matter, the one from dental, the other from surgical and medical, sources. Other sections contain original contributions, not from the Society's transactions.

In some respects this journal opens up a new field for dental periodical literature. We note the absence from its pages of society, college and other local and general movements in dentistry. No matters not strictly connected with the higher scientific progress of the profession are found recorded in its pages. In fact, the absence of much which (to quote from the prospectus), "possessing merely local or temporary value, makes no mark on the record of professional excellence," forms the basis for the new departure. The intention appears to be to make this journal, as nearly as possible, an exposition of the *science, pur et simple*, of American dentistry, leaving other matters (without, however, denying or belittling their professional interest and value) to the various other journals.

Again, although the magazine is published by a dental manufacturer, yet its whole literary portion is under the sole control and

direction of the New York Odontological Society. This will form a bar, in this case, to the charge of manipulation of the reading matter in the interest of the manufacturer,—a charge made against almost all the other dental periodicals,—and is a movement in the direction of independent journalism.

These main features constitute the novelty of the enterprise. Three numbers have appeared, and we may truly say that if the journal is maintained at the standard of excellence already reached, the "Dental and Oral Science Magazine" will, without question, be *facile princeps* in the ranks of American dental journalism.

The general character of the Canada and St. Louis journals is that which is already familiar to us in the older dental periodicals. The possibilities of emancipated editorship, however, are, indeed, somewhat marked in each, and notably so in the Canada journal.

Notwithstanding these steps taken to secure an unbiased medium of professional thought, our general periodical literature comes far short of what we should desire to see it.

Certain faults in the method of conducting the literary department of our periodicals have driven some of the best men of our profession to either keep their ideas and results to themselves, or to express them only through the medium of their local society meetings; and as but few of these latter publish their transactions, and of those which are published the circulation is very limited, our periodical literature, under the present régime, can present only a very partial and unfavorable view of the highest present attainments of dentistry in this country, and your committee see no means of placing the profession justly on record except by the establishment of an absolutely untrammeled journalism.

DISCUSSIONS.

Dr. McQuillen: The report claims that the publishers of our journals, who are interested in the manufacture or sale of dental goods, are influenced by mercenary considerations in the management of their magazines. Now, from my long connection with this department of literature, I know it is utterly impossible to carry on what is called an independent magazine. It is impossible for even the medical profession to do this. Publishing-houses are dependent to a great extent upon the advertisements that

come in as a source of revenue. I say if we are to have a magazine, let it be one that will be a credit to us,—that shall have some character and weight. The Odontological Society claims to publish an independent journal. We are told that, under the condition governing that society, there will be freedom of expression. What is the Odontological Society?—the "creme de la creme" of the profession, the society of societies among dentists,—composed of most estimable, high-toned and honorable men, for whom I have the most profound respect; but a certain number of them come together, looking upon themselves in this light—some of them among the best operators in the world—and what do they do? They allow themselves to be made use of as the mouthpiece for, and I may say the indorsement of, the so-called "new departure!" Is it not so? They may not mean it, but they give these doctrines an indorsement by giving them such great prominence in their columns. My friend Bogue called upon me several years ago and said, "Can't we get up an independent journal? We are bound down by the thralldom of the publishers." "Can we not subscribe money toward having an independent journal?" I said, "If your pockets are deep—if you have plenty of money—if you can pay a man of experience two or three thousand dollars a year, and keep on doing so for ten or twelve years, you may perhaps run an independent journal. If, however, you expect the dental profession is going to do this, you are very much mistaken."

Dr. ATKINSON: We are under a heavy cloud of ignorance, and it would require very close and shrewd discrimination for us to say just what had been and what had not been beneficial in the various publications that have appeared in the scientific, medical and dental journals. That there is a difficulty in the way is very manifest. What is that difficulty? We have had no editor, in textbook or journal, that was adequately competent to the fulfillment of that duty. What is the duty of the editor of a journal for distribution in any literary, scientific or professional circle? It evidently is, that he may have such discrimination as to enable him to select suitable matter irrespective of the personality of speakers or writers. I have been pained beyond measure, for three years, in consequence of a leading article in THE DENTAL JOURNAL OF THE WORLD, and the excuse of the editor, when I was pleading with him to leave it out for the good of the profession, was, that it

was all he had at command. I. replied, "You had better have nothing, better have an entire blank, than to have such driveling idiocy that has pained every man of any heart or any brains, for the last three years, in the articles referred to, on "Dental Pathology and Therapeutics."

As to having an independent journal: There is a very great difficulty, and it requires us to know what we mean by an independent journal. There is no such thing as independency. We have to do the best we can under the circumstances, so far as dental literature is concerned. With all the errors that are found in the "Dental Cosmos," I will set it up a hundred to one against anything published in the English language, for usefulness to the dental profession, and for direct terseness and selection of the part worthy to be reported. Many times the pressure has been so great on the publishers of that journal as to compel them to put in the mere verbiage of "Officers," etc., as minutes of the society. Why was it borne with? Just as you bear with the irregularities of infants in your arms. Now we have come to a position where it is not worth while for us to do so any more.

REPORT

ON

OPERATIVE DENTISTRY.

By MARSHALL H. WEBB, of the Committee.

OPERATIVE Dentistry includes within its range the application of remedial agents for the correction of perverted function and removal of abnormal growths, that the physiological energies may be free to normally produce and maintain the elements of the tissues and organs; the observance of dentition throughout its different phases, that irregularity of the teeth may be averted, modified or corrected, and the performance of such operations as shall prevent or arrest disintegration or caries.

The deciduous teeth should be retained till displaced by the advancing permanent ones, but it is sometimes necessary to remove disintegrated tissue and fill the cavities in them, that they may be thus preserved. These deciduous organs should be extracted when devitalization of the pulp occurs, and particularly when abscess has taken place, for the reason that solution and absorption of the tissues of the roots of these teeth (as the permanent advance and press upon them) does not normally take place after the death of the pulp, and such absorption is necessary that malposition of the permanent teeth may be prevented.

As the deciduous teeth are dislodged and the permanent ones erupted, an examination should frequently be made, not only for the purpose of averting irregularity of the organs, but to ascertain whether disintegration has commenced upon the proximate surfaces of any of the teeth, or in the fissures of bicuspids and molars.

Disintegration of enamel may be prevented by occasionally polishing the proximal surfaces of the teeth, and having the patient pass floss-silk between them daily. This will not require more

attention on the part of the operator and patient than where so-called permanent separations have been made.

When disintegration has commenced near the part of one tooth that is in contact with another, and after the teeth have been separated by pressure, so that needless cutting of enamel may be avoided, the superficial layer of disintegrated enamel prisms should be removed (after the rubber-dam has been applied) by the use of fine files, and strips cut from emery-cloth or paper of the finer grades, such as No. ½ and No. o. If, after this superficial layer has been removed, the whole surface presents the appearance of normal tissue, it should be carefully polished with pulverized pumice applied upon linen tape or a soft rubber disk. If there remains a portion of enamel of a different shade than that which surrounds it, all the disintegration has not been removed, and it may extend to the dentine, thus necessitating the cutting out of all the disintegrated tissue and the thorough preparation and careful filling of the cavity presented.

"Permanent separations" ought not to be made because they interfere with mastication, annoy the patient, and, with few exceptions, do not prevent disintegration upon or about the surfaces that have been cut. Food wedges at the part where the teeth again come in contact (which they almost invariably do, excepting where antagonists prevent them); this food becomes putrescent, disintegration takes place, and that, too, in a part of the tooth where it is difficult to perform a first-class operation. All this may not take place, however, until the tactile corpuscles throughout the gum-tissue pressed upon have become paralyzed, and the patient is not notified of the presence of impacted food.

As it is better to use tin, oxy-chlo. zinc, gutta-percha or amalgam than to improperly or imperfectly insert gold, so also is it better to cut away a part and endeavor to save what remains of a tooth than to deprive the patient of the organ altogether; but operators ought to have a higher appreciation of fine and beautiful tissue than to content themselves with simply being capable of using an alloy, even if they can properly prepare the cavity of decay, insert the material and finish it, or to insert gold and then cut away enamel so as to conform to such filling, and to make permanent separations, and thus mar the beauty and at least partially destroy the usefulness of priceless organs.

When disintegration has advanced along a fissure or in a sulcus, or the sulci of a bicuspid or molar tooth, the rubber-dam should be neatly applied to the tooth in which such a cavity is found, as well as to the one or more adjoining, so that the parts may be made dry and brought more plainly to view. If decay has made considerable progress beneath, and the opaque carious dentine can be seen through the plate of translucent enamel, the cavity should be opened into by means of enamel-chisels. The softer portions of carious dentine should then be removed by sharp excavators, the fissures sufficiently opened, and anchorage for the filling made by keen burs operated with a "dental engine." The walls should be well shaped, with very little undercut; the margins of enamel evenly and smoothly finished with fine, sharp plug-finishing burs (so-called); a starting-point made (if one of the fissures does not serve the same purpose), and the whole cavity so prepared that all the gold may be impacted by aid of the mallet.

It is necessary to apply the rubber-dam to obtain desirable results in the class of cases just referred to, and no permanent operation should be performed where decay attacks the buccal and labial surfaces, unless this most valuable of all the aids be properly applied. This can and should be done in all cases, provided the operator has the ability to successfully use the same; and although pressure upon the gum is necessary that the rubber-dam may be carried to the necks of the teeth, to be operated upon, yet, when properly applied, and ligatures of waxed floss-silk are used, inflammation of the tissue pressed upon will not take place, excepting, perhaps, in rare instances, when it will soon subside. That operations be performed as well as possible, it is necessary that the parts be kept free not only from saliva by the use of the rubber-dam, but also from all moisture; even the vapor contained in the exhalations from the lungs, as well as the touch of a finger, will prevent the cohesion of gold, which cohesion is essential to success in the performance of all, and particularly the higher type of operations.

Whether the material to be used for a permanent filling be gold or tin, a half-leaf of light foil for small, a whole leaf for medium, and two leaves for large operations should be taken from the place in the book in which it comes by means of a spatula or the foil-carriers, and placed upon a piece of spunk, which has been cov-

ered with white kid. This foil should be folded with an ivory spatula into a tape-like form of about four, eight or ten lines in width, respectively, then taken up in the foil-carriers and cut across into parts about a line wide. As these parts are cut from the ribbon, they should fall upon spunk, covered with kid, from which they can be readily taken with small-pointed foil-carriers or the packing instrument. Heavy foils (such as Nos. 30 and 60) may be used to great advantage, especially in the restoration of the contour of missing tissue, although light foil, when prepared as just described, can be more easily impacted into small cavities, fissures and grooves.

Any preparation of gold can be made more uniform in density, with greater ease and rapidity, by the aid of a properly adjusted electro-magnetic mallet, operated by a full current of electricity and guided intelligently, than by any other known method.

As each piece of properly prepared foil is passed over the flame of alcohol and introduced into the cavity (either by an assistant with light-pointed foil carriers, or by the operator himself with the packing instrument), and simply attached to the part (one or two pieces) placed by hand in the starting-point or that already there, the electro-magnetic mallet should be set in operation, and the finely-serrated point of the packing instrument placed *(not pressed)* against and made to operate upon the gold in a manner somewhat similar to that of making dots on paper with a pencil. Light, hard, or graduated blows can be made without changing the adjustments of the instrument, as fine or heavy lines are made on paper with a pen. When the electro-magnetic mallet is operated and guided as here indicated, gold can be carried against and over the margins (even frail edges) of enamel without fracturing them, and without the instrument passing off and puncturing the rubber-dam and wounding tissue. Almost the same blow is required throughout each and every operation, because the gold should be solid and uniform in density; hence the action of the battery ought always to be regular, so far as intensity and constancy are concerned, and the pieces of gold for a given operation should be about the same in size and in degree of cohesiveness, and be uniformly and solidly impacted.

All gold should be cohesive, especially when a mallet is used, so that each piece may remain just where it is placed, and also

that the filling may always be one and inseparable. If there be no affinity between particles, a thoroughly useful, beautiful and permanent operation cannot well be performed; neither can the precious cohesive particles "exhibit enduring strength," unless each body of particles or piece of gold be carefully, thoroughly and perfectly impacted.

If in impacting gold any part or the whole becomes displaced, it ought to be removed at once, otherwise the filling would be imperfect. Gold in the form of pellets and cylinders and in a non-cohesive condition may be used in some so-called simple cases; but when really fine or first-class operations are to be performed, foil ought to be so carefully prepared, introduced and impacted that the operator can be positive that each piece has been firmly anchored, attached, or has adhered to that already in position, and being certain of this, the filling may be made solid and uniform in density, and the organ operated upon fully restored to usefulness.

When caries takes place in the labial portion of an incisor or cuspid and buccal surface of a bicuspid or molar tooth, and the cavity extends beneath the margin of the gum (as also with some cavities within proximal surfaces), it is sometimes difficult to apply the rubber-dam; but then a ligature of waxed floss-silk should be placed twice around the tooth which is to be operated upon, after it is secured to the adjoining tooth or teeth, and while holding the ends of the ligature in the left hand, and just before tying the last knot which is to tighten such ligature, both it and the rubber-dam should be pressed above the margin of the cavity, so as to bring it into view and secure dryness. In such cases it is often necessary to hold the ligature, together with the rubber-dam, above the margin of the gum by means of a broad-pointed excavator; but before commencing such an operation, it is best to have everything at hand that may be required. A clamp should be used when the rubber-dam is to be applied to the lower, and at times upper, molar teeth. The clamp should be first adjusted to the tooth, and the rubber-dam then stretched over it from the posterior to the anterior part, and be also applied to the adjoining tooth or teeth.

After the removal of carious dentine with sharp excavators, the margins of such cavities should be evenly and smoothly finished, and all disintegrated enamel removed by means of fine, sharp burs. A slight undercut should be made around the cavity along the line

where the enamel and dentine coalesce, and a starting-point be drilled in a direction where there is no liability of the drill going in too close proximity to pulp-tissue. The first piece of foil should be placed in such starting-point, and after that has been inserted, all the gold ought to be impacted with the mallet. When the cavity is entirely filled, the gold should be trimmed down to conform to, and be even with, the surrounding surface of enamel by means of sharp chisels and files or fine burs. All this should be done previous to the removal of the rubber-dam, after which the gold and surrounding enamel ought to be finely finished with pulverized pumice, applied upon wood, leather or rubber points.

Disintegration upon the approximal surfaces of the teeth commences, almost invariably, just above the part in contact in the upper and just below it in the lower teeth, and when the dentine is reached, caries advances beneath the enamel in all directions. When this takes place upon the proximate surfaces of the incisor and cuspid teeth, they should be separated by the wedging of wood, or pressing of linen tape or cotton between them. After sufficient space has been made, white gutta-percha should be placed in the cavity and between the teeth, and remain a day or two, till the irritation incited by the wedging has passed away. Rubber ought never to be used for the purpose of separating teeth, because of the irritation which it induces. Quick wedging is frequently necessary, and it is often best to place a wedge of orange wood between the teeth, even after having pressed them apart, not only to gain more space, but to stay the tendency to approximation, and to make the organs more steady during the performance of the operation or operations, especially if the irritation from the previous wedging has not passed away sufficiently to admit of the insertion of all, or almost all, the gold by aid of the mallet. When the required space has thus been gained, the rubber-dam should be applied, the quick wedging resorted to if found necessary, and the operation commenced. The cavity should be carefully prepared, the edges of enamel smoothly and uniformly finished, a groove or undercut made toward the cutting edge and at the cervical wall (so-called), and a starting-point drilled along such wall toward the palatal edge; all such anchorage should be made in the dentine, just inside the line of enamel where these two tissues coalesce. In the filling of these cavities, particularly the

small ones, more than those in any other location, it is necessary to use what is known as "hand pressure," and pack some of the gold (into undercuts) with small curved instruments, having fine and sharp serrations. Cohesive gold can be very successfully used in these cases also; but only when prepared from a half sheet of light foil, such as No. 4, and so folded as to be equivalent to No. 16, and then cut into strips about a half line wide. In many of the class of cavities here referred to, as well as in most others, all the gold can best be impacted with the quick and decided blow given by the short stroke of the electro-magnetic mallet. The whole operation of inserting the gold should be performed as before indicated, and be so completed that there shall be a perfect restoration of the contour of the missing tissue.

After the preparation of such cavities as just referred to, particularly the larger ones, and previous to the insertion of the gold, the margin of enamel should be smoothly finished with, but not rounded by, emery-cloth, first with a strip cut from No. ½, and then one from No. o. When the gold has been impacted, and its surface trimmed down to the edge of the enamel which surrounds it, and the whole made to conform to the contour of the tissue which the gold is to substitute, by means of a No. 1 or No. o Froid-file upon the proximal surface and labial edge, and a fine bur upon the palatal portion, strips of fine emery cloth should be so manipulated as to perfectly finish the surface of the gold, and to leave the parts smoothly and beautifully formed. All this had best be done previous to the removal of the rubber-dam, after which the filling should be completed by the use of finely pulverized pumice and then silex, each mounted and applied upon fine linen tape. Rouge may be then applied upon a strip of fine chamois skin. Fine pumice, silex and rouge leave a finer finish than, but not so bright a lustre as, a burnisher, which instrument ought not to be used.

All operations ought to be performed as perfectly and artistically as possible, so that if gold is exposed to view, it shall not be repulsive to sight. The gold should be so impacted against the dentine and enamel that, when the operation shall have been completed, and the surface of enamel made clear and bright again, the gold tint may be seen through the light walls or edges of the translucent enamel, thus evincing that the filling was perfectly inserted.

When, through disintegration, the enamel of a proximal surface of a bicuspid or molar tooth is penetrated, and the dentine is involved in the disintegrative process, separation by pressure is here, also, necessary. While sufficient space may be gained between the incisor teeth by what is known as "rapid wedging," yet such wedging of bicuspids and molars cannot be so easily and rapidly accomplished, and especially when the cavity extends almost to the margin of cementum; although in such case the gold can be built into and from the starting-point, and along the "cervical wall" and to the part to where the convex portion of the filling should be carried, and, after this much of the gold has been impacted and smoothly finished, a wedge of wood may then be inserted between such gold and the tooth adjoining, and sufficient space thus secured to enable the operator to so complete the operation that there shall be no space between the teeth excepting at and near the necks. If the operator cannot do this, then a wedge of boxwood may be placed from the neck to a part about midway between it and the masticating surface of the tooth, and cut away with burs to the shape the filling should be, but such an appliance should not be depended upon to retain any portion of the filling. Separation by pressure must be made in some way, else gold cannot be built out and finished so that the teeth may again closely approximate and prevent the wedging of food between them, excepting, perhaps, in the case of a youthful person, when the space left from the finishing of the fillings by fine files and emery cloth may again close. Undue and long-continued pressure of the parts upon the capillaries held within the connective tissue, which covers the cementum, may prevent the return to normal and free circulation within such vessels after the wedge has been removed, but this result may follow only when proper care has not been taken, or the wedge too rudely or violently applied.

After sufficient space has been gained in the manner described, the rubber-dam should be applied to the two teeth that have been separated by pressure, and to the tooth adjoining each, that the teeth separated may not approximate, to some extent, during the performance of the operation or operations, and the organs can be operated upon with greater facility. Excepting in rare instances, a cavity within the proximal surface of a bicuspid or molar should

be opened into from the masticating surface, because, even where but little tissue appears to be involved in the disintegrative process, this surface would be almost reached upon the perfect removal of the disintegration, and the plate of enamel would be liable to fracture if hard substances were to come in contact with it while food is being comminuted. It is far better to cut away the enamel between the cavity and masticating surface than to sacrifice tissue along the entire proximal wall; besides, a better view can be thus obtained, and the whole operation more perfectly performed. In addition to this, the adjoining fissure or sulcus usually requires attention, and should be prepared and filled in connection with, and at the time of, the performance of the operation within the proximal wall. Each and every cavity ought to be so prepared that no disintegrated tissue remains; the margins should be evenly and smoothly finished with fine burs, files and emery cloth (the edges may be beveled in some cases, but not rounded), and a groove be cut along each wall of the cavity. This groove should not be more than a thirty-second, and rarely but a sixty-fourth of an inch in depth, and should be made in the dentine just within and near the line of both the buccal and palatal or lingual portions of enamel, and to extend from the masticating surface to the cervical wall, along which a groove should not be cut because of there not being sufficient depth of tissue to make it safe to remove any of it for such a purpose. Where function has been interrupted and the tissues have not been perfected (as well as in some other cases), the enamel and dentine remaining between and a little above the normal edge of the gum and margin of the cavity (if decay has not advanced to this part) should be cut away with fine burs. Such preparation should be made to about (or a little more than) half a line beyond the margin of the gum, because chemical action takes place at the surface of liquids, and as the surface of saliva is usually at about the same line with the gum, disintegration may take place at such part (even though the whole operation shall have been otherwise thoroughly and well performed) unless tissue be removed and the gold (or any other material) properly inserted and its surface finely finished beyond and about the line just referred to. When the gum is in normal condition it embraces and so perfectly protects the portion of enamel (and well inserted and finely finished gold) which may be

beneath its margin, that disintegration, and even discoloration, is prevented.

In deep, or relatively deep, cavities, carbolic acid should be applied to the dentine, not only to serve as a disinfectant, but that the protoplasm of the ends of the protoplasmic strings (in the tubuli and crossing the intertubular tissue and also found between the enamel prisms) may be coagulated, and sensation be thus partially obtunded.

In cases where thermal changes may produce more than the usual shock in healthy tissue after the operation has been performed,— oxychloride of zinc, "cement plombe," or "agate cement"— should be placed in the bottom of the cavity as a non-conductor of thermal currents in the protoplasmic strings.

When a cavity within the proximal wall of enamel of a bicuspid or molar tooth has been prepared as described, a starting-point should be made along the cervical wall, and at that point in the dentine which shall be the safest along the line of its coalescence with the other hard tissue of the part, the enamel or cementum. This point, in which to start the filling, should not be deep, yet sufficiently so to retain the small pieces of gold first introduced and impacted until other pieces are built upon them, and so far as, and along to, the groove in each wall,— the buccal and palatal or lingual. The gold ought to be built against every part of the dentine, impacted as nearly perfect as possible along the enamel and a little beyond its margins, and fully carried out to the line that defined the contour of the missing tissue. To thus fully perform such an operation it is necessary to build the gold (or rather that part of it nearest the buccal and masticating surfaces) against the proximal surface of the adjoining tooth. By performing this operation with a properly adjusted electro-magnetic mallet, the passing of the packing instrument from off the edge against or over which the gold is being impacted, may not only be avoided, but the surplus material can be so trimmed away during the performance of the operation that comparatively little is afterward necessary to make the part restored conform to the original type. In these cases (as well as others) the gold ought to be cohesive and be prepared and manipulated as hereinbefore described. Cohesive gold-foil, properly prepared, can and should be used in the performance of all operations, and all be impacted by aid of the

mallet when it is properly operated, and especially in the cases just referred to, and those where frail edges of enamel are to be supported and protected.

When the gold has been so impacted, piece by piece, that the substitution for lost tissue is complete, a fine saw, file, or some such suitable instrument, should be used to cut away the surplus gold, and to aid in making the filling conform to the original contour of the part; after which narrow strips cut from fine emery-cloth should be so manipulated as to perfectly finish the surface and leave it properly formed. When this has been done, and the rubber-dam removed, the finishing should be completed by the use of fine pumice and silex upon linen tape, as before suggested. The gold at the masticating surface should be finished with fine burs, and, by their aid, made concave or to conform to the original type of the part operated upon. The gold should be so impacted as to be flush with the prepared margins of enamel, yet, even then, made concave where such concavity is indicated. Fine burs should be used for the purpose of trimming and shaping such fillings, because the form of the remaining part or parts of the cusps and prepared edges of enamel against which the gold is impacted may be changed and the teeth made less useful where corrundum points are used. The polishing of the gold upon the surface referred to may be done with pumice and silex, mounted on wood, leather or rubber points.

Whether a cavity be large or small, the gold ought to be built out to the original contour, and, at its periphery, a very little beyond the margin of enamel, then finished down to the surface of such enamel, and the whole filling made to conform to the line that defined the contour of the lost tissue; contour signifying "the line that bounds, defines, or terminates a figure." This line ought to be restored to that degree commensurate with the extent of destruction of tissue. If the gold be not impacted against, and be not flush with the edges of enamel, the operation is not such as is demanded for the preservation of remaining tissue. A plain surface of gold should not be made, because the enamel of the tooth thus operated upon may approximate closely that of the other, and disintegration may take place upon the surface of the enamel near or at the part in contact. Restoration of contour prevents such contact, and this prevention is necessary, especially where the tissues of the organ operated upon are not fully calcified. The con-

tour of missing tissue ought always to be so restored with gold that the enamel of one organ may be free from contact with that of the next in the arch, and also that a part of the gold in the one may approximate and be certain to rest firmly against the normal tissue of, or a filling (if one has been inserted) in, the adjoining tooth, when disintegration is not likely to take place, because of the freedom from proximity and the cleansing (by the saliva) of the margins of enamel against which the gold has been placed and finely finished.

When operations have been so performed as to entirely prevent fluids or semi-solids from entering between the material and the tissue against which it has been placed, the gold-tint may be seen through the light walls or edges of translucent enamel, immediately upon or soon after the removal of the rubber-dam and completion of the operation. If an opaque or dark line, or spot, be visible at or near the parts where gold ought to be in contact with dentine and enamel, the operation has been imperfectly performed, and chemical action may soon follow and the entire filling prove a failure. The cause of such failure might be attributed to in-"compatibility" of gold with dental tissue, but this would be a departure from the truth. If operators were always very thorough in their work there would be no occasion to refer the cause of these failures in dental operations to chemical action.

When operations have been performed in the manner herein described, and all the fillings as carefully and skillfully inserted and finely finished as suggested, they are the best for the preservation of remaining tissue, protection of the enamel over which the gold has been placed, and for the prevention of the wedging of food against and the consequent recession of the gum; they subserve well the purpose of mastication, and present a beautiful appearance.

Even when a case presents where the tissues are diseased and decay is extensive, and with here and there a crownless root, such a case should be properly treated; all operations that may be required ought to be performed as perfectly as possible, and artificial crowns placed upon the roots, (especially those in the anterior part of the mouth,) in accordance with some one of the best methods that have been described,— from that of the plain porcelain crown fastened to the root with fine, well-seasoned

hickory wood, and all interstices between the crown, wood and tissue closed by white gutta-percha that can be nicely manipulated, to the building of a gold crown with a porcelain face. Even where a root is missing, such a porcelain face with gold attachments can be successfully built into the two adjoining teeth. Both these last mentioned operations were described and illustrated by the writer in the *Dental Cosmos*, June, 1873.

VOLUNTEER PAPER ON OPERATIVE DENTISTRY.

By GEO. J. FRIEDRICHS.

QUERY: Is the keeping of cavities dry an absolute necessity in the filling of teeth, in order to preserve them?

From the time I commenced the study of dentistry, thirty years ago, there has been a tacit admission on the part of the members of the profession at large, and it has been openly taught by the authorities in our dental colleges, that it was absolutely necessary to keep cavities dry during the operation of filling; and to substantiate the truthfulness of my assertion, I shall quote from the writings of prominent members of the profession on this subject. Prof. Stellwagen says in Vol. xi, No. 12, Dental Cosmos, page 621: "To-day the profession is most united in urging upon the young the constant employment of saliva-pumps, napkins, dams, etc., as essential for the attainment of the highest degree of perfection in their operations."

Dr. Chase, Vol. 1 Missouri Dental Journal, No. 7, page 252, says: "We must all come up to the standard of dry cavities; its importance is the very ground-work of all good plugging; there can be no good plugs made without they remain perfectly dry until the gold is all packed."

Dr. Cushing, in a paper read before the Illinois State Dental Society, on "Filling Teeth," Missouri Dental Journal, Vol. 1, No. 7, page 300, says: "The next important thing to be observed, preparatory to filling, is the securing the absolute dryness of the cavity, however that end may be attained."

The above quotations are certainly all-sufficient to show the teachings of the profession on this point.

What inference, then, are we to draw from the above assertions? It is positively stated that no good fillings can be inserted unless the cavity is kept perfectly dry. Now, fillings are evidently put into teeth to serve a certain purpose other than ornamental; it then follows, reasoning *a priori*, that unless the cavity is kept perfectly dry failures must ensue, but "facts are stubborn things."

I have kept a record of cases where I was unable to keep the cavity dry to the end of the operation, and I find, after a period of ten years, that they bear the test of time as well as others that I filled in the same mouth, in which I succeeded in excluding moisture.

My first case on record was a little girl, aged nine, whose first molars, both the superior and inferior, required filling. I succeeded in keeping the cavities dry to the end of the operation in the two superior molars, but in trying to fill the inferior I found it a matter of impossibility to do so. These two teeth I filled under protest — that is, I informed the mother that I was not responsible for the results that might follow, as I did not believe that the fillings would last two years; and, furthermore, if she knew of an operator in the city who could fill them properly that it was her duty to have him refill them. This advice was not acted upon, but the little girl was brought to me every six months to have those teeth examined.

I have filled for her since many more teeth, and, to all appearance, those two which were filled over ten years ago, and under the circumstances above stated, are in as good a state of preservation to-day as the rest of her teeth that were filled, and where moisture was excluded to the end of the operation.

I could give many other cases in which the results were the same. I will add that all the cases in which I was unable to keep the cavities dry to the end of the operation were in the teeth of the inferior maxilla, and in the mouths of children.

Keeping in view our object, the next question that arises is, What constitutes a good filling? In my opinion the following points must be attained before we can have any expectation of success in the preservation of the teeth:

First. The material employed must be, to all intents and purposes, indestructible in the oral cavity.

Second. The material employed must be packed solid, so as to render it impermeable, and secured in such a manner that it will require force to dislodge it.

Third. It must be left flush with the orifice of the cavity, and finished in such a manner that it can be kept clean.

Therefore, whenever the above conditions are obtained, it is self-evident the filling must be good, whether it is put in dry or wet.

It may be, that with cohesive foil, or crystal gold, the above-mentioned conditions cannot be fulfilled unless the cavity is kept perfectly dry; but does this prove that it cannot be accomplished with non-cohesive foil in the shape of cylinders?

I contend that such a thing as an absolutely dry cavity in a tooth, while in the mouth, is unattainable, and can only be so relatively.

The science of physics teaches us that no two substances can at one and the same time occupy the same space. Therefore it follows, that when a cavity in a tooth is filled with gold, this space occupied by the gold cannot be occupied by something else.

And in conclusion, when cohesive foil or crystal gold is used, there is an absolute necessity to keep the cavity dry, and the gold from becoming moist during the operation. Unless this condition is obtained, a solid and impermeable plug cannot be made with these two forms of gold.

And unless a filling perfectly excludes, and is impermeable to, extraneous substances, no hope can be entertained of its aiding in the preservation of a tooth from future decay. For a filling in a tooth is not a restoration of the parts lost through decay, but merely a patching up; and in doing this, the dentist performs no radical cure, for he does not remove the original cause, which still remains present after the operation is completed.

VOLUNTEER PAPER ON OPERATIVE DENTISTRY.

By D. D. SMITH.

WHO has not mentally asked the question, as he has taxed himself and his patient to almost complete exhaustion in some dental operation of unusual magnitude or length, is there not some way either to prevent this destruction of tissue or to restore these organs when attacked, unattended by the severe mental and physical strain upon the operator, and the shrinking, dread, and suffering to the patient which the present general practice and teaching involves?

Is the popular impression true that generation after generation the teeth of civilization are degenerating, and their power of resisting decay lessening? and shall dentistry still persist in averting the evil by the use of one remedy, mechanically applied, in all cases and in all conditions?

Is there no consolation other than this that the profession can offer to the tens of thousands who have never shared its blessings, and to many others suffering abuse from burring-engines, dental mallets, rubber-dams, and other appliances, who are in doubt if it confers a blessing or a curse?

Has not the present aspect of dentistry a near parallel in the practice of general medicine of a few years ago, when calomel was of almost universal application? Every age, temperament, and condition felt its power for good or evil. Whatever the trouble, cerebral, thoracic, or abdominal, local or general, calomel as a remedy had its advocates. A generous and earnest spirit in medical science, aiming to relieve suffering and prolong human life, searching for cause and observing effect, broke the bonds of established usage and teaching; tried other means and remedies, until now, with the truly educated, mercury in any and all its forms is but an adjunct in general practice.

Medicine is not so narrow as to withhold its hands from remedies of merit, because, forsooth, they are not hoary with age and use.

Do not the broken arches and the edentulous mouths, continu-

ally presenting, plainly testify that dentistry as now taught and practiced is unable to cope with the diseased conditions of human teeth?

If the profession would avert this evil, observation must be more extended and accurate; new remedies must be sought and applied; investigation by experiment made popular, and the employment of other than mere mechanical remedies encouraged.

The deductions from the teaching of all our text-books, from periodicals and society discussions, point to the use of one filling material only in a given cavity — and that efficient in proportion as it is mechanically manipulated — for the treatment of all carious conditions and for the restoration of teeth.

If gold is recommended, the inference, if not the positive teaching, is that the filling, to be honestly and efficiently made, must be *all* of gold; if tin is the material, the cavity must be filled entirely with tin; and so also of amalgams, gutta-percha, and oxychloride of zinc. The exception to this is in some more recent and advanced teachings on the use of gutta-percha, tin, lacto-phosphate and the oxychloride cements as coverings for exposed pulps, and different materials for use in roots, whatever may be adopted to complete the filling. It is not too much to say that any consideration or discussion of other filling materials than gold, of their composition or methods of use, of their behavior in varied conditions of the oral cavity or of their distinctive properties, has been evaded or frowned upon as too elementary and unimportant to engage the attention of writers or speakers. The desire to be known only as a "first-class operator" has held timid ones chained almost exclusively to the mechanical use of one material, and caused the loss to dental science of many an otherwise earnest investigator.

To inquire if some two or more of the present filling materials cannot be conjointly used in the same cavity for better preservation and greater comfort to the tooth; also to inquire if there may not be some hitherto unsuspected therapeutic action in dental oxychloride of zinc preparations, are the special objects of this paper.

That fillings fail because of lack of adaptation to the walls of cavities is a fact generally believed and admitted, and that gold is the most difficult material to *perfectly* adapt in many cases is also known and admitted. That the oxychloride of zinc cements are among the best, if not *the best*, preservatives in cavities of decay is

a truth which will become as fully admitted when it is as well understood. If decay has ever been known to commence anew under an oxychloride of zinc filling when in place, the attention of the writer has never been called to the fact.

Chloride of zinc locally applied is recognized as among the most efficient agents known for promoting healthy granulations, as "in addition to its escharotic properties it appears to exercise a greater influence over the vital action of neighboring parts" than most other caustics, the separation of its eschar leaving healthy and vigorous granulations. It is equally efficient as an antiseptic and a disinfectant. As an application to chronically inflamed and suppurating gums at the festooned margins, after the removal of tartar, it probably has no equal. This liquid meeting so fully the indications for an antiseptic, and for a stimulant to the production of healthy tissue in a cavity of decay — mixed with the various preparations of oxide of zinc, forms a close and seemingly impervious union with the walls of cavities.

There are good reasons for the belief that these cements when properly manipulated not only exclude moisture, but that they do for diseased dental tissue what chloride of zinc does for more vascular tissue, viz., *stimulate the production of healthy structure* in the parts with which they are brought in immediate contact and in the near surroundings.

Illustration: Ten years ago a cavity of decay was filled on the mesial face of a left superior sixth-year molar with oxychloride of zinc and gold. The decay was deep-seated and involved the whole mesial face of the tooth. A portion of softened dentine was left covering the almost exposed pulp, and the oxychloride placed directly upon it. Enough of this cement was cut away to allow for the introduction of a gold filling, to protect the walls of the cavity and the oxychloride. The tooth was of a character to decay readily and rapidly, but the only object had in view in filling the cavity in the manner described was the better protection of the pulp, by interposing a non-conductor between it and the gold. Something more than six years after, it was deemed advisable to remove this filling for the purpose of gaining access to a small cavity in the distal face of the second bicuspid, which had been forced backward by occlusion until it rested in the concavity of the finished surface of the gold-filling. The conditions were such

that the removal of this filling permitted access to the cavity in the bicuspid without cutting or wedging, hence the adoption of the plan. Other fillings made entirely of gold and introduced about the same time in other teeth in this mouth had failed, and had been replaced in the meantime.

The dentine under the gold and oxychloride in question had undergone a decided transformation, changing from soft to hard and dense structure, seemingly capable of resisting decay without further protection. This exhibition of the beneficial action (as it seemed) of the oxychloride of zinc made a profound impression; and as its cautious use in all classes of cavities from that time to the present has given correspondingly good results, the most favorable conclusions have been formed for the practice of *lining* all cavities with an oxychloride cement, whatever the external filling is to be.

In many cases time can be saved in filling, the certainty of the operation increased, and the tooth rendered more comfortable to the patient; and further, thousands of pulps which under the all-gold system must be sacrificed or capped but to die under the filling, can by this method be comfortably and permanently saved.

The antiseptic and stimulating action of the chloride of zinc is of a most beneficial character, inducing in many cases better organization of the tissues in the living parts to which it is applied.

The manipulations in their simplest form consist in excavating a given cavity in the usual way and then filling entirely with some one of the best oxychloride of zinc cements,—under the rubber-dam if practicable. Having been allowed to set and harden for a few minutes, enough of the cement is cut away or excavated to form a cavity for securely introducing a gold-surface filling. By this means the cavity can be nearly filled, or merely lined with the cement, and *it* kept from disintegration by a filling of gold. The color of the tooth is thus preserved, the pulp isolated from thermal shocks, and the preservation of the tooth more certainly secured.

In ordinary crown cavities, and in many cases of deep-seated caries in approximate cavities, this manner of procedure simplifies and shortens the operation of filling, but in small or shallow cavities complicates it. The cavity may be of such a nature as to render the conjunction impracticable. When such cases occur, the cavity can be filled entirely with gold, tin, or any other filling

material in the usual way. In deep-seated crown and other cavities where under-cuts exist, if the enamel is strong it need not be cut away, for when the decay is removed and the cement carefully and securely packed in its place, it forms a support when hard equivalent to true dentine. A cavity cut in it to a depth a little greater than the thickness of the enamel reduces the final filling with gold to an operation of the simplest character, as this new cavity has a hard, firm base of cement, and a boundary of cement and tooth-material, or of the latter alone.

It may well be inquired if there are not some objections to the use of the oxychloride cements in the manner proposed. There is one objection, and it is believed to be the only one worthy of mention: it causes pain in the tooth immediately on application, varying in degree and duration with the extent of the decay and the character of the tooth. The sharpest and most prolonged pain is usually experienced in young or soft teeth, and its duration is from three to fifteen, and rarely to thirty or even sixty minutes. The pain is greatly lessened or entirely obviated by dextrous and intelligent manipulation, which will follow a study of its peculiarities and its continued use.* Its extensive application for the past two years in all classes of teeth and cavities, as a covering for recently exposed pulps and in hyperesthetic conditions of the dentine, has failed to develop an uncontrollable or even a markedly obstinate case of odontalgia.

Exposed pulps may be first protected with lacto-phosphate and a Weston cap, with an oxide of zinc *pad*, with gutta-percha, or in any manner which seems most desirable, and the cement placed over the capping used. The oxide of zinc pad is made by mixing the powder of any oxychloride cement with creasote or oil of cloves, using but a very small quantity of either liquid. By patting this mixture with a spatula it can be worked into a mass aptly termed a *pad*. This can be used as a covering applied directly to the pulp, or to prevent pain in deep-seated caries. It is unquestionable that the therapeutic action of the oxychloride is much diminished, if not completely arrested, by a covering of gutta-

* It has been urged that the chemical combination which is the result of bringing together oxide and chloride of zinc destroys the therapeutic effect of the latter, but the fallacy of such reasoning is shown by the facts here stated; and further, an application of oxychloride of zinc carelessly or injudiciously made produces pain undistinguishable in character from that of an application of chloride of zinc in the same place.

percha over the pulp, while the oxide of zinc pad modifies but does not prevent its action, and for this reason it is esteemed, and has proved in practice, a better and safer capping for pulps than gutta-percha.

That the action of the chloride of zinc is not wholly interrupted by the *pad* is evident in the fact that the powder of which the pad is made becomes in a short time consolidated and almost homogeneous with the oxychloride of zinc used to cover it.

To recapitulate, we find the advantages of the oxychlorides, as linings or as basal fillings, to consist in the saving of time; perfect apposition of filling material with the walls of cavities; solid base and actual support to frail walls; secure anchorage for metallic fillings; ready adaptation in places difficult or impossible of access with gold; no discoloration of the material itself, and a preventive of discoloration in dentine; comfort, especially to highly-organized teeth; a stimulant to the production of healthy tissue, and the most effectual preservative known in dentistry.

REPORT OF COMMITTEE

ON

DENTAL CHEMISTRY.

By L. G. NOEL, of the Committee.

IN the early days of medicine, physicians who proposed to cure diseases upon strictly chemical principles were treated with scorn and derision by those who held to the mystical teachings of the empyrics, and the followers of Silvius de la Boe, who was in the zenith of his career the leader of the chemical school, were dubbed with the opprobrious cognomen of "chemichers." Notwithstanding the gloom which surrounds the subject of organic life is so dense as to be impenetrable, even to the glare which chemical science in the nineteenth century has thrown upon the field of medicine, we take the ground that these subtleties will yield only to the onslaughts of chemistry. We willingly place ourselves in a position to have the term "chemicher" leveled at us. The teachings of Van Helmont, Silvius and Des Cartes, though crude, and calling forth the sneers and scorn of their contemporaries, were, nevertheless, vitalized by a soul of truth, whose immortal energy is still living, while they rest from their labors.

The etiology of caries of the teeth has been one of the most subtle questions with which pathologists have had to deal; and while your committee cannot promise a chemical analysis, or synthetical exegesis of the subject, we do propose to call attention to some of the explanations which chemistry offers, and which, to us at least, seem more satisfactory than the visionary teachings of Magitot, Leber and Rottenstein, and others of the fungi school.

In 1874, at Detroit, we endeavored to lay before the society our views in regard to the destructive action of acetic and lactic acids upon the teeth, as generated in the mouth from the chemical changes which starch undergoes when left to decompose about

them. Four years have wrought no change in our views upon that subject. (Trans. Am. Dental Assoc., Detroit, 1874, pp. 151, 152.)

The starchy foods permitted to remain about and between the teeth are converted by the saliva into glucose or grape sugar, the fermentation of which results in acetic and lactic acids. These acids convert the tribasic lime phosphate of the teeth into the bibasic phosphate, leaving it in a softened condition, capable of being washed out. Another lodgment of food occurs in the same pocket, to undergo the same changes, another bite by the acids results in more softening, and thus a cavity is formed.

Recently we have had some notable cases coming under our observation, showing conclusively the destructive nature of sugar upon the teeth, where it is used largely as a food, and permitted to become acidulated between and about them.

L. S., a white boy, aged eighteen, employed in a candy factory, presented himself for operations upon his teeth. An examination of the mouth showed a most deplorable condition of things. The teeth were not only decayed on their proximate surfaces, but rings of softened enamel were revealed, by the touch of the excavator, all about their necks. A. B., a colored man who had been engaged in a candy factory for twenty-five years, applied to have his teeth extracted, with a view to the construction of an artificial set. His jaws were furnished only with two rows of stumps, the teeth having dissolved away in an acid saliva. The litmus test was used in both these cases, showing decided acidity.

While speaking of the destructive nature of the sugar-acids, we would present a thought that has often occurred to us; but because of our inability to prove conclusively anything in connection with it, we would only offer it suggestively. May not oxalic acid be one of the products of the splitting of the sugar molecule in the mouth, forming the oxalate of lime by its union with the phosphate? What acid would prove more destructive, and what having a stronger affinity for lime? Oxalic acid is made on a large scale by the action of hydrate of soda and hydrate of potash upon sawdust; but it may be made experimentally by the action of nitric acid upon starch or sugar. It was long known as the acid of sugar, from this fact. Sugar has the property of forming compounds with many alkaline bases, but notably with lime. A solution of cane sugar is capable of dissolving a large quantity of lime,

forming a compound which may be represented by the formula $CaOC_{12}H_{22}O_{11}$.

It is not incredible that sugar, constantly present in the mouth, may greatly assist in the washing out of the lime-salts after they have been subjected to the disintegrating action of its acids; and this, we have thought, may account to some extent for the rapid dissolution of the teeth of individuals employed in candy factories, where sweets are kept constantly in the mouth. The experiment of Dr. Cassidy, detailed in an essay read at Chicago last year, in which he gave the result of a test of the action of acetic and lactic acids out of the mouth, go far toward proving the activity of these acids upon the lime-salts of which they are composed; but the utter impossibility of securing the same conditions that obtain in the mouth, necessarily deprives an experiment of this kind of much of its force. The theory sometimes advanced, that nitric and sulphuric acids arise from the decomposition of meats between the teeth, we think has little foundation in fact, and is rather far-fetched.

The chemical analysis of beef-flesh gives us:

Water	77.5
Albuminous matter	16.0
Fat	5.0
Mineral salts	1.5
	100.0

Now, in the putrefaction of meat, the oxidation of its albuminous portion is the first step of dissolution. The analysis of albumen may be given proximately as follows:

Carbon	52.0
Hydrogen	6.9
Nitrogen	15.6
Oxygen	24.0
Sulphur	1.5
	100.0

The carbon then would be resolved into carbonic acid, CO_2, and the hydrogen, nitrogen and oxygen into ammonia, NH_3, and water, H_2O. Then what becomes of the sulphur? Is it changed into sulphuric acid to convert the teeth into gypsum, mere plaster models of the original beautiful structure?

The odor arising from putrid flesh tells that story too forcibly to make chemical analysis necessary. HS, sulphuretted hydrogen, is formed either by an appropriation of nascent hydrogen or by the decomposition of a portion of the water present. The hypothesis that nitric or sulphuric acid may result from the putrefaction of flesh, we believe untenable. Hydrochloric acid is more readily accounted for in the breaking up of the chloride of sodium molecule; but this would have but a moderate affinity for any but the lime carbonate of the teeth.

The ammonia arising from decomposing flesh may, and we think probably does, dissolve out the animal matrix, thus furthering the progress of decay. It is not all the work of acids, and we should be careful how we recommend alkaline dentifrices in those cases where the gums have shrunken beyond the enamel border, exposing the cementum, for by so doing we may develop softened rings around the necks of the teeth.

Much attention is now being drawn to the subject of electro-chemical action as explanatory of the decay around metallic fillings, but to this we have not given sufficient thought to justify an entrance upon it. With the lights before us now, we are ready to lay down as an axiom that the greater part of dental decay arises from the decomposition of starchy and saccharine substances in the mouth.

DISCUSSION.

Dr. ATKINSON: This report, like all others on special departments, entirely ignores that upon which it stands. Chemistry cannot stand alone, any more than any other department of science. What we call chemical science is but the chemical aspect of general science. You cannot have any consciousness of gathering your ideas together without a chemical process; nor is there an organization of any kind in which there is not a chemical phase in its production; and having said that, it is not worth while for me to recapitulate that which ought to be known to every graduate of any respectable school, viz., that the changes that are destined to occur, and usually do take place, in the stomach should not be asserted to transpire in the mouth, as was stated in the report we are discussing. The secretions that are possible in the mouth

cannot produce the effects attributed to them by the report. To find these we will have to go to the stomach, and give attention to investigations that are not more than ten years old, to enable us to understand the preparation of peptones and albumenoses. If we expect to have our chemistry, which is a part of our dental literature, brought to anything like a respectable status, we must make a new departure, and study it simultaneously with all the other exact sciences.

TRANSACTIONS

OF THE

American Dental Association

AT THE

NINETEENTH ANNUAL SESSION,

BOSTON MEDICAL LIBRARY ASS.
AUG 12 1891

HELD AT NIAGARA FALLS,

Commencing on the 5th of August, 1879.

PUBLICATION COMMITTEE.

GEO. H. CUSHING, J. N. CROUSE, GEO. W. KEELY.

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CONTENTS.

Disclaimer, - - - - - - - - - - - - - - - 2
Officers for 1878–9; 1879–80, - - - - - - - - - - - 6
Roll-call, - - - - - - - - - - - - - - - 7
Motion adopting Programme, - - - - - - - - - - - 9
Vacancies filled in Executive Committee, - - - - - - - 9
Motion of Dr. Hunt, referring President's address, - - - - - 9
Report of Publication Committee, - - - - - - - - - 10
Action thereon, - - - - - - - - - - - - - 11
Report of Treasurer, - - - - - - - - - - - - - 11
Report on Credentials, - - - - - - - - - - - - 14
Report of committee on President's address, - - - - - - 16
Motion of Dr. H. A. Smith on death of Dr. McQuillen, - - 11
Report of committee on same, - - - - - - - - - - 17
Memorial page, - - - - - - - - - - - - - 23
Remarks of Dr. Rehwinkel, - - - - - - - - - - 23
Remarks of Dr. Barrett, - - - - - - - - - - - 24
Remarks of Dr. Spalding, - - - - - - - - - - - 24
Remarks of Dr. Stellwagen, - - - - - - - - - - 25
Remarks of Dr. Beck, - - - - - - - - - - - - 25
Remarks of Dr. Atkinson, - - - - - - - - - - - 25
Motion of Dr. Peirce for a voluntary subscription, - - - - - 12
Resolutions on Directory by Dr. McNaughton, - - - - - 13
Report of committee on Volunteer Papers, - - - - - - - 13
Motion of Dr. Taft for committee to send dispatches to the press, - 13
Motion of Dr. Hunt to divide report on Education, and action thereon, 14
Resolutions by Dr. McNaughton, - - - - - - - - 15
Motion of Dr. Dean for extra session, - - - - - - - - 16
Motion of Dr. Crouse to pay bills, - - - - - - - - 17
Committee on Directory, - - - - - - - - - - - 17
Motion of Dr. Harlan to appoint committee on National Association, 18
Committee appointed, - - - - - - - - - - - - 18
Resolution of Dr. Stellwagen as to applause, - - - - - - 19
Election of officers and selection of place of next meeting, - - - 19
Motion for members to remain in their seats and to vote open ballots, 19
Motion of Dr. Atkinson, instructing Recording Secretary, - - 19
Motion of Dr. Spalding for Sections to meet, - - - - - - 19
Motion of Dr. Shepard for Sections to meet, - - - - - - 19

Motion of Dr. Hunt, instructing members of Sections, - - - 20
Motion of Dr. Spalding, changing order of calling of Sections, - - 20
Motion instructing Treasurer, - - - - - - - - - 20
Motion of Dr. Stockton — thanks, etc., - - - - - - - 21
Resolutions by Dr. Atkinson on sale of fraudulent diplomas, - - 21
Notice of amendments to Constitution, - - - - - - 21–22
Publication Committee appointed, - - - - - - - - 21
Reorganization of Sections, - - - - - - - - - - 21
President's address, - - - - - - - - - - - - 27
Letter from Dr. George Watt, - - - - - - - - - 29
Reply to same, - - - - - - - - - - - - - 32

REPORTS AND VOLUNTEER PAPERS.

SECTION ONE.

Report by R. Finley Hunt, Chairman, - - - - - - - 33

SECTION TWO.

Report on Education by J. N. Crouse, Chairman, - - - - - 50

SECTION THREE.

Report on Dental Literature by J. Taft, - - - - - - - 74
Report on Nomenclature and Terminology by W. H. Atkinson, Chair'n, 90

SECTION FOUR.

Report on Operative Dentistry by I. J. Wetherbee, Chairman, - - 101
Report on Operative Dentistry by Geo. B. McDonald, of the Section, 106

VOLUNTEER PAPERS.

On Operative Dentistry by Thos. C. Stellwagen, - - - - - 110
On Operative Dentistry by Geo. J. Friedrichs, - - - - - 112

SECTION FIVE.

Report on Physiology by M. S. Dean, Chairman, - - - - - 121
Physiological Observations on the Action of Nitrous Oxide, by Julius G. W. Werner, - - - - - - - - - - - - 126

DISCUSSIONS.

Artificial Dentistry — discussed by
Dr. Stockton, - - - - - - - - - - - - 33, 41
Dr. J. Taft, - - - - - - - - - - - 33, 43, 48
Dr. Atkinson, - - - - - - - - - - - 34
Dr. Essig, - - - - - - - - - - - 37, 42
Dr. Stellwagen, - - - - - - - - - - - 39, 42
Dr. Butler, - - - - - - - - - - - - 39
Dr. Rehwinkel, - - - - - - - - - - - 40
Dr. McDonald, - - - - - - - - - - 41, 45
Dr. Crouse, - - - - - - - - - - - 42
Dr. Clump, - - - - - - - - - - - - 45
Dr. Barrett, - - - - - - - - - - - 45

Dr. Hunter, - - - - - - - - - - - - - 46
Dr. Thomas, - - - - - - - - - - - - 47
Dr. Bogue, - - - - - - - - - - - - - 48
Dr. Friedrichs, - - - - - - - - - - - - 48, 49
Dr. Spalding, - - - - - - - - - - - - - 48
Education — discussed by
Dr. Spalding, - - - - - - - - - - - - 53, 70
Dr. Bogue, - - - - - - - - - - - - 55, 59
Dr. Stockton, - - - - - - - - - - - - 56
Dr. Shepard, - - - - - - - - - - - - 57, 58, 66
Dr. H. A. Smith, - - - - - - - - - - 57, 58, 59
Dr. Crouse, - - - - - - - - - - - - 58, 60
Dr. Cook, - - - - - - - - - - - - - 59
Dr. Werner, - - - - - - - - - - - - - 61
Dr. Atkinson, - - - - - - - - - - - - 62, 63
Dr. Barrett, - - - - - - - - - - - - 63, 64
Dr. Stellwagen, - - - - - - - - - - - - 64
Dr. Hunt, - - - - - - - - - - - - - 68
Dr. Peirce, - - - - - - - - - - - - - 70
Dr. Rehwinkel, - - - - - - - - - - - - 71
Dental Literature — discussed by
Dr. Bödecker, - - - - - - - - - - 85, 86, 87, 88
Dr. Spalding, - - - - - - - - - - - - 86
Dr. Werner, - - - - - - - - - - - - 87
Dr. Bogue, - - - - - - - - - - - - 87, 88
Dr. Atkinson, - - - - - - - - - - - - 88
Nomenclature and Terminology — discussed by
Dr. Atkinson, - - - - - - - - - - 95, 97, 99, 100
Dr. Spalding, - - - - - - - - - - - - 97
Dr. Barrett, - - - - - - - - - - - - 98
Dr. Friedrichs, - - - - - - - - - - - - 99, 100
Dr. Werner, - - - - - - - - - - - - 100
Operative Dentistry — discussed by
Dr. Hunt, - - - - - - - - - - - - 116, 117
Dr. Friedrichs, - - - - - - - - - - - - 116, 117
Dr. Atkinson, - - - - - - - - - - - - 116
Dr. Stellwagen, - - - - - - - - - - - - 117, 119
Dr. Darby, - - - - - - - - - - - - 118, 119
Physiology — discussed by
Dr. Peirce, - - - - - - - - - - - - - 125
Physiological Observations on Action of Nitrous Oxide — discussed by
Dr. Osmond, - - - - - - - - - - - - - 130
Dr. Peirce, - - - - - - - - - - - - - 131
Dr. Atkinson, - - - - - - - - - - - - 131
Dr. Werner, - - - - - - - - - - - - 133
Dr. Barrett, - - - - - - - - - - - - - 134

OFFICERS.

FOR 1878–9.

President,	H. J. McKELLOPS, -	St. Louis.
First Vice-President,	L. D. SHEPARD, - -	Boston.
Second Vice-President,	L. D. CARPENTER, -	Atlanta, Ga.
Recording Secretary,	GEO. H. CUSHING, - -	Chicago.
Corresponding Secretary,	A. O. RAWLS, - -	Lexington, Ky.
Treasurer,	W. H. GODDARD, - -	Louisville.

FOR 1879–80.

President,	L. D. SHEPARD, - -	Boston.
First Vice-President,	C. N. PEIRCE, - - -	Philadelphia.
Second Vice-President,	GEO. L. FIELD, - -	Detroit.
Recording Secretary,	GEO. H. CUSHING, - -	Chicago.
Corresponding Secretary,	M. H. WEBB, - - -	Lancaster, Pa.
Treasurer,	W. H. GODDARD, - -	Louisville.

EXECUTIVE COMMITTEE.

J. N. CROUSE, Chairman. C. S. STOCKTON, Secretary.

FIRST DIVISION—COMMITTEE OF ARRANGEMENTS.

FILLEBROWN,* COOK AND BARRETT.*

SECOND DIVISION—ON CREDENTIALS AND AUDITING COMMITTEE.

CROUSE, KEELY AND STOCKTON.

THIRD DIVISION—ON VOLUNTEER PAPERS.

PEIRCE, MORGAN* AND BLACK.

LOCAL COMMITTEE OF ARRANGEMENTS.

THOS. FILLEBROWN, J. G. W. WERNER AND C. A. BRACKETT.

* These go out August, 1880.

BOSTON MEDICAL LIBRARY ASSOCIATION
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MINUTES OF TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION

SESSION OF 1879.

By GEO. H. CUSHING.

FIRST DAY—MORNING SESSION.

THE AMERICAN DENTAL ASSOCIATION commenced its Nineteenth Annual Session at the Pavilion, in Prospect Park, Niagara Falls, Tuesday, August 5, 1879, at 11 A.M.; the President, H. J. McKellops, in the chair.

The session was opened with prayer by Dr. C. S. Stockton.

The roll of qualified members was then called, and the following members answered to their names:

1	* ALLEN, JOHN	314 Fifth ave., New York.
2	ATKINSON, W. H.	41 East Ninth st., New York.
3	* ALLPORT, W. W.	Chicago, Ill.
4	BOGUE, E. A.	29 East Twentieth st., New York.
5	* BROPHY, T. W.	126 State st., Chicago.
6	BIDDLE, C. H.	50 Livingston st., Brooklyn, N. Y.
7	BECK, C. S.	Wilkesbarre, Penn.
8	BUTLER, C. R.	Cleveland, Ohio.
9	BROWN, SENECA B.	Fort Wayne, Ind.
10	* BRACKETT, C. A.	Newport, R. I.
11	BARRETT, W. C.	Buffalo, N. Y.
12	BÖDECKER, C. F. W.	73 West Forty-fifth st., N. Y.
13	* COLTON, A.	Hudson, N. Y.
14	CROUSE, J. N.	734 Michigan ave., Chicago.
15	CUSHING, GEO. H.	34 Monroe st., Chicago.

Those marked thus (*) were absent but sent their dues.

16	COWIE, HENRY	Detroit, Mich.
17	COOK, C. D.	133 Pacific st., Brooklyn, N. Y.
18	*CHAIM, M. L.	30 Cooper Institute, N. Y.
19	CLEL'AND, JAMES	Detroit, Mich.
~~20~~	~~DEAN, M. S.~~	34 Monroe st., Chicago.
21	DARBY, E. T.	1513 Walnut st., Philadelphia.
22	DABOLL, G. C.	Buffalo, N. Y.
23	DAVIS, K. B.	Springfield, Ill.
24	ESSIG, C. J.	1533 Locust st., Philadelphia.
25	EMMINGER, A. F.	Columbus, Ohio.
26	FIELD, GEO. L.	Detroit, Mich.
27	FREEMAN, S. A.	14 Court st., Buffalo, N. Y.
28	FRIEDRICHS, GEO. J.	155 St. Charles st., New Orleans.
29	*FILLEBROWN, THOS.	Portland, Maine.
30	*FREEMAN, A. W.	675 Wabash ave., Chicago.
31	FLAGG, EBEN M.	54 Bible House, N. Y.
32	FINLEY, M. F.	Ypsilanti, Mich.
33	GODDARD, WM. H.	Louisville, Ky.
34	GUILFORD, S. H.	4006 Chestnut st., Philadelphia.
35	*GAYLORD, E. S.	New Haven, Conn.
36	HARLAN, A. W.	70 Dearborn st., Chicago.
37	*HUEY, ROBT.	330 South Fifteenth st., Philadelphia.
38	HUNT, R. F.	1806 H st., Washington, D. C.
39	HOYSRADT, G. W.	15 North Cayuga st., Ithaca, N. Y.
40	HALL, J. W.	1337 Washington st., St. Louis.
41	HARROUN, C. H.	Toledo, Ohio.
42	*HOW, W. STORER	Cincinnati, Ohio.
43	HUNTER, E.	Jackson, Mich.
44	*HOLMES, A. M.	Morrisville, N. Y.
45	HANKS, J. C.	Newark, N. J.
46	*HOOPER, J.	Owenton, Ky.
~~47~~	~~*INGERSOLL, L. C.~~	Keokuk, Iowa.
48	*JACKSON, H. H.	319 Jefferson ave., Detroit, Mich.
49	KLUMP, G. W.	Williamsport, Penn.
50	KEELY, GEO. W.	Oxford, Ohio.
51	LYMAN, A. E.	Warren, Ohio.
52	LEVY, FRED A.	Orange, N. J.
53	*MCMANUS, JAS.	Hartford, Conn.
54	MCKELLOPS, H. J.	1127 Washington ave., St. Louis, Mo.
55	MERRITT, CHAS.	25 West Twenty-third st., N. Y.
56	MORGAN, HENRY W.	Nashville, Tenn.
57	MCNAUGHTON, D. C.	129 Grand st., Jersey City, N. J.
58	MCDONALD, GEO. B.	Conneautsville, Penn.
59	*MORRISON, W. N.	St. Louis, Mo.
60	NORTHRUP, A. L.	44 West Forty-sixth st., N. Y.
61	*NOBLE, H. B.	1111 Penn ave., Washington, D. C.

60	ODELL, F. M.	18 West Eleventh st., N. Y.
61	OSMOND, E.	266 Vine st., Cincinnati, Ohio.
62	* PALMER, S. B.	39½ Warren st., Syracuse, N. Y.
	PEIRCE, C. N.	1617 Green st., Philadelphia.
63	PRIEST, A. N.	Utica, N. Y.
	* PAGE, W. E.	3 Dexter Row, Boston.
65	RICHTER, R. G.	Milwaukee, Iowa.
66	RICHARDS, F. J.	Williamsport, Penn.
67	* RHONE, J. W.	Bellefonte, Penn.
68	REHWINKEL, F. H.	Chillicothe, Ohio.
69	* SWARTLEY, J. S.	785 Michigan ave., Chicago.
70	SHEPARD, L. D.	100 Boylston st., Boston.
71	STOCKTON, C. S.	Newark, N. J.
72	STELLWAGEN, THOS. C.	1627 Chestnut st., Philadelphia.
73	* SPALDING, C. W.	1606 Olive st., St. Louis, Mo.
	SMITH, H. A.	286 Race st., Cincinnati.
74	TAFT, J.	117 West Fourth st., Cincinnati.
75	THOMAS, G. R.	Detroit, Mich.
	TAFT, WILL	93 East Fourth st., Cincinnati, Ohio.
	* WATERS, G. F.	8 Beacon st., Boston.
	WEBB, M. H.	Lancaster, Penn.
	WERNER, J. G. W.	41 Upton st., Boston.
	* WETHERBEE, I. J.	46 Dover st., Boston.
76	* WHITAKER, GEO. W. H.	Sandersville, Ga.
77	WATLING, J. A.	Ypsilanti, Mich.

The following gentlemen, not being present, sent their dues for 1878: Swain, E. D.; Nichols, Gorton; Smith, Joshua; Kitchen, C. A.

The President then read the annual address.

Upon motion of Dr. Hunt, amended by Dr. Taft, the address of the president was referred to a special committee of three, whom the chair appointed as follows: Drs. J. Taft, R. Finley Hunt and Geo. W. Keely.

On motion, the programme offered by the Executive Committee, with slight amendment, was adopted.

The Executive Committee reported that they had filled vacancies in the board by electing Drs. C. S. Stockton, E. T. Darby and S. H. Guilford.

The Publication Committee submitted the following report:

The Publication Committee respectfully submit the following report:

They have published four hundred copies of the proceedings of the session of 1878, and have transmitted copies of the same to all members entitled to them; also to various libraries, and to the dental journals in this and foreign countries. They have on hand about two hundred copies. They have also had printed one hundred pamphlet copies of the amended constitution.

The following is a statement of their account with the Association.

AMERICAN DENTAL ASSOCIATION, TO THE PUBLICATION COMMITTEE.

Dr.

To publication of 400 copies of Transactions, and 100 copies of Constitution		$340 26
" Printing notices regarding sections		3 00
" Engraving		15 75
" Postage, stationery and expressage		30 65
		$389 66

Cr.

By cash from Treasurer	$240 00	
" " " sale of Transactions	3 00	
		243 00
Balance due the Committee		$146 66

We have examined the above and find it correct, August 5, 1879.

J. N. CROUSE.
GEORGE W. KEELY.
C. S. STOCKTON.

The committee desire to call the attention of the Association to the fact that several of the papers read before it at the last session were published in the journals before the Transactions were issued.

Such publication is clearly in contravention of a universally accepted law governing such matters; which law recognizes all papers read before such bodies as this to be the sole property of the same.

To avoid any misunderstanding for this year, the committee would suggest the adoption of the following resolution:

Resolved, That all papers read before this body shall be considered as the sole property of the Association, and shall not be published elsewhere than in the regular Transactions — previous to the appearance of the latter — except by consent of the Association; and the Publication Committee is instructed to exclude from the Transactions any paper which may be published contrary to this resolution.

They would further recommend the adoption of the following amendment to the constitution, viz: Under the head of "Instructions to the Publication Committee," after the words "still on hand," insert:

Any report or other paper, to be entitled to publication in the volume of

Transactions for the year in which it shall be presented to the Association, must be placed in the hands of the Publication Committee on or before the first day of September, and must also be so prepared that the proof sheets furnished the authors shall be returned to the committee without material alteration or addition.

Every paper received by this Association, and all plates or other means of illustration, shall be considered the exclusive property of the Association, and shall be published for its exclusive benefit.

GEO. H. CUSHING, *Chairman.*
J. N. CROUSE.
GEORGE W. KEELY.

Upon motion of Dr. Atkinson, the report was accepted.

Dr. Atkinson moved that the report be divided, referring the financial portion to the Executive Committee, and retaining the other portion for action by the Association. Carried.

He then moved that that portion now before the Association be laid upon the table. Lost.

Dr. Shepard moved the adoption of the report. After discussion by Drs. Shepard, Atkinson, Spalding, Friedrichs, Stellwagen, Hunt, Peirce, Cook and Cushing, the motion prevailed.

The President presented a letter from Dr. Watt, which upon motion was read by the Secretary.

On motion of Dr. Spalding, the Corresponding Secretary was instructed to make a suitable reply to the same, both of which will be found in the body of the work.

On Dr. Shepard's motion, the letter was further referred to the Publication Committee.

On motion of Dr. H. A. Smith, the Chair appointed the following committee to draft resolutions on the death of Dr. John H. McQuillen: H. A. Smith, W. H. Atkinson and M. S. Dean.

The Treasurer read the following report, which was adopted:

WM. H. GODDARD, TREAS., IN ACCOUNT WITH AM. DENTAL ASSOCIATION.

1878.	*Dr.*	
August 6.	To balance	$158 66
1879.	" cash from Dr. M. S. Dean	1 65
August.	" cash received for dues during the year	665 00
		$825 31

Cr.

1878.	By paid Committee of Arrangements	$72 50	
	" " " on Sections	28 25	
	" " Secretary's salary	100 00	
	" " Treasurer's salary	100 00	
	" " Engraving Certificate	91 00	
	" " Committee for Programmes	5 00	
	" " Reporter	150 00	
	" " Pub. Com. Engraving	15 00	
	" " Pub. Com. Transactions	225 00	
	" " Incidental Expenses, etc	7 35	
			$794 10
	Balance		$31 21

WM. H. GODDARD, *Treas.*

Audited and found correct.

J. N. CROUSE,
GEO. W. KEELY, } *Committee.*
C. S. STOCKTON,

Dr. C. N. Peirce moved that a voluntary subscription be made to liquidate the present indebtedness of the Association. Amended by Dr. Taft to refer the subject to a committee of two and by Dr. Shepard to refer to the Executive Committee. It was referred to the Executive Committee.

On motion of Dr. Crouse, adjourned to meet at 7:30 P.M., in order that the sections might have time to act.

FIRST-DAY—EVENING SESSION.

Association convened at 8 o'clock. President McKellops in the chair.

Minutes of morning session read and approved.

Report of first section, reporting progress, was read by Dr. R. Finley Hunt, chairman.

The subject of Artificial Dentistry was then discussed by Drs. Stockton, Atkinson, Essig, Stellwagen, R. Finley Hunt, C. R. Butler, Rehwinkel, McDonald, Crouse, Taft, Klump, Hunter, H. A. Smith and Bogue.

A motion to adjourn was lost. Dr. Friedrichs continued the discussion, after which the Association adjourned to 10 A.M. tomorrow.

SECOND DAY—MORNING SESSION.

The Association was called to order at 10:30 A.M. President McKellops in the chair.

The minutes of the previous session were read and approved.

Dr. McNaughton offered the following resolutions:

Resolved, That a committee, consisting of one member of the Association from each state and from the District of Columbia, be appointed by the President to make (with the assistance of the state societies) a complete directory of the dentists of the United States.

Resolved, That the members of the committee be directed to bring the project before their several state and district societies, that such action may be taken as will rectify the directory each year.

Resolved, That when any state or district society shall present to this Association a list, alphabetically arranged, of dentists within such state or district, then this Association shall, through its Committee on Directory, present to such state or district society all lists of dentists in its possession; and shall continue to exchange the amended lists as long as such shall be continued by the several state and district societies.

A motion to lay on the table, by Dr. Peirce, was lost.

After discussion by Drs. Shepard, Hunt, McNaughton and Odell, the resolutions were adopted.

The Committee on Volunteer Papers reported favorably on two papers on operative dentistry, one by Dr. Stellwagen and one by Dr. Friedrichs.

A bill for a seal was presented, and ordered paid.

On motion of Dr. Dean, the subjects of the first section were passed.

Dr. Taft moved the appointment of a committee of three to secure the sending of proper notices of our proceedings to the various papers in the country. Carried, and the Chair appointed as such committee Drs. Taft, Shepard and Stellwagen.

Upon the call of the second section, a report was read by the chairman, Dr. Crouse. On motion, it was received.

Upon motion of Dr. Hunt, the report was divided: one part to embrace only the resolutions, the other part to embrace the remainder. A motion was made to adopt the report without the resolutions. After discussion by Drs. Spalding, Bogue and Stockton, upon the motion of Dr. Shepard, it was laid upon the table.

Dr. Shepard moved to adopt the resolutions which were divided from the report.

Discussed by Drs. H. A. Smith, Cook, Bogue, Crouse, Werner, Atkinson, Barrett, Stellwagen, Shepard, R. Finley Hunt, Peirce, and Rehwinkel.

Upon motion of Dr. Taft, the resolutions were divided. Each to be acted on separately.

Dr. Taft moved the adoption of the first resolution.

Dr. McNaughton offered the following as a substitute:

Resolved, That hereafter no dental college shall be entitled to representation in this Association that does not require an examination of its matriculants; the grade of which shall equal that required for graduation from the Boston Grammar School.

On motion of Dr. Crouse, the substitute was laid on the table. First resolution was then adopted.

Dr. Shepard then moved the adoption of the second resolution, which prevailed.

The third resolution was, on motion of Dr. Shepard, adopted.

The Executive Committee made a partial report, which, by subsequent reports, was completed, as follows:

American Academy of Dental Science—L. D. Shepard.
Chicago Dental Society—M. S. Dean, J. N. Crouse.
Dental Society of the State of New York—A. N. Priest, G. W. Hoysradt, S. A. Freeman, W. C. Barrett, A. M. Holmes.
Dental Department of Vanderbilt University—Henry W. Morgan.
First District Dental Society of New York—W. H. Atkinson, C. F. W. Bödecker, E. M. Flagg.
Illinois State Dental Society—Geo. H. Cushing, A. W. Harlan, K. B. Davis.
Indiana State Dental Association—Seneca B. Brown.

Kentucky State Dental Society—W. H. Goddard.
Michigan State Dental Society—M. F. Finley.
Michigan Dental Association—Henry Cowie.
Mississippi Valley Association of Dental Surgeons—R. G. Richter, E. Osmond.
New Jersey State Dental Society—C. S. Stockton, D. C. McNaughton, J. C. Hanks, F. W. Levy.
Northern Ohio Dental Association—C. R. Butler.
Odontological Society of Pennsylvania—M. H. Webb, S. H. Guilford.
Odontological Society of the City of New York—A. L. Northrop.
Ohio Dental Society—C. H. Harroun.
Pennsylvania State Dental Society—E. T. Darby, C. J. Essig, G. B. McDonald.
Pennsylvania Association of Dental Surgeons—Robert Huey.
Pennsylvania College of Dental Surgery—C. N. Peirce.
Philadelphia Dental College—Thos. C. Stellwagen.
Washington Dental Society—R. Finley Hunt.

Association then adjourned.

SECOND DAY—EVENING SESSION.

Association convened at 8:15 P.M. President McKellops in the chair.

The minutes of morning session were read and approved.

The following resolutions were offered by Dr. McNaughton:

WHEREAS, The continued financial depression has caused the rank and file of the dental profession throughout the country to greatly reduce their fees for services rendered; and

WHEREAS, A large majority of the standard articles used by the profession remain at about war prices; and

WHEREAS, A large proportion of the improvements and inventions relating to dentistry are the result of suggestions made by the dentists themselves; therefore, be it

Resolved, That we deem it our right to demand of manufacturers of and dealers in dental goods, such reduction in their prices as will more nearly correspond with the depressed financial condition of the times.

On motion of Dr. Harlan, the resolutions were laid on the table.

On motion, the subject of second section was passed, and the third section was called.

Dr. Taft read the report on Literature, which was discussed by Drs. Bödecker, Werner, Bogue and Atkinson,—after which Dr. Atkinson read the report on Nomenclature and Terminology, at the close of which, on motion, the Association adjourned.

THIRD DAY--MORNING SESSION.

Association convened at 10:30 A.M. President McKellops in the chair. Minutes of evening session read and approved.

The Executive Committee made a partial report.

Dr. Dean moved that an extra session be held this afternoon at 4 o'clock, for the selection of next place of meeting and the election of officers. Carried.

A communication was read from Mr. Delano, presenting claim for rent of Grant's Hall, which was referred to the local Committee of Arrangements.

The committee to whom was referred the President's address, presented a report through Dr. Taft, its chairman, which was adopted, as follows:

The special committee to whom was referred the address of the President, respectfully report that many of the suggestions contained therein have already been disposed of by the action of the Association.

One of those not so disposed of referred to the encouragement of inventors and manufacturers exhibiting their productions at our annual meetings. The committee concur in the propriety of this encouragement, but believe that it will be practically effected in a business way by individual members, without action by the Association.

To secure a wider dissemination of our proceedings, as suggested by the President and Secretary, the committee recommend that copies of the printed Transactions be distributed each year by the Secretary to such public libraries and other institutions as may be designated by the Publication Committee.

The most important suggestion before the committee is that relating to the "concentration of the entire strength of the profession in our truly national body."

A committee was appointed last year with the understanding (not expressed in the resolution creating it) that it would consider this subject and report on it at this meeting. It is hoped that that committee will make

such suggestions as will lead to this most desirable union and concentration. Otherwise it is now recommended that the Association take steps looking definitely to that end.

J. TAFT.
R. FINLEY HUNT.
GEORGE W. KEELY.

On motion of Dr. Crouse, all bills properly authenticated were ordered to be paid.

The regular order of business was then resumed, and the discussion on Dr. Atkinson's report was participated in by Drs. Atkinson, Spalding, Barrett, Friedrichs and Werner. On motion of Dr. Klump, the subject was passed.

On motion, the rules were suspended and a verbal report of the Executive Committee relative to the demand for rent of Grant's Hall was received.

Dr. Taft moved that the Recording Secretary be instructed to make a proper reply. This was amended, to refer the subject back to the committee, and the Secretary instructed to notify the parties of this fact.

The Committee on Resolutions, on the death of Dr. McQuillen, presented their report, which was received. Touching and eloquent remarks were made by Drs. Rehwinkel, Barrett, Stellwagen, Spalding, Beck and Atkinson, and the report was unanimously adopted by a rising vote. See memorial page.

The President announced the following Committee on Directory:

COMMITTEE ON DIRECTORY.

D. C. McNaughton, Jersey City, N. J., *Chairman.*

Maine	Thos. Fillebrown.	Maryland	F. J. S. Gorgas.
New Hampshire, Vermont, Massachusetts	W. E. Page.	D. of C.	R. F. Hunt.
Rhode Island	C. A. Brackett.	Virginia	J. H. Moore.
Connecticut	J. McManus.	W. Virginia	D. B. McLane.
New York	S. A. Freeman.	N. Carolina	E. Floyd.
Delaware	J. E. Register.	S. Carolina	Thos. T. Moore.
Pennsylvania	G. W. Klump.	Florida	R. F. Phillips.
		Georgia	G. W. H. Whitaker.
		Alabama	E. S. Chisholm.

Mississippi ....J. D. Miles.
Louisiana. ....G. J. Friedrichs.
Texas .....J. A. Tulloss.
Arkansas .....E. Collins.
Kansas .....A. H. Thompson.
Tennessee.....H. W. Morgan.
Kentucky .....A. O. Rawls.
Ohio .....A. F. Emminger.
Indiana .....S. B. Brown.
Illinois .....A. W. Harlan.
Michigan .....Geo. L. Field.
Wisconsin.....Arthur Holbrook.
Minnesota ....D. C. Price.
Iowa .....L. C. Ingersoll.
Nebraska.....T. C. Kern.
Colorado .....J. C. Fuller.
Nevada .....W. O. Conwell.
California .....Wm. Dutch.
Oregon .....S. J. Barber.
Territories at Large ..... } E. T. Darby.
Missouri .....J. G. Harper.

Section 4 was called and a report written by Dr. Wetherbee was read by Dr. Daboll, and one by Dr. McDonald read by himself. A volunteer paper was then read by Dr. Stellwagen, followed by one by Dr. Friedrichs, all discussed by Drs. R. Finley Hunt, Darby and Osmond up to the hour for adjournment. Upon motion of Dr. Taft, the time was extended, to enable the Secretary to get the names of members of sections. After which adjourned, to meet at 4 P.M.

THIRD DAY—AFTERNOON SESSION.

Association convened at 4:30. President McKellops in the chair.

Minutes of morning session were read, corrected and approved.

Dr. Harlan moved that a committee of three be appointed, in accordance with the recommendation of the special committee to whom was referred the President's address, to devise means to secure the concentration of the entire strength of the profession in one truly national body. Carried.

The Chair appointed as that committee, Drs. Harlan, Rehwinkel and Peirce.

On motion of Dr. Dean, the President — Dr. McKellops — was added to the committee.

Dr. Atkinson offered a resolution, which was recommitted for amendment of phraseology.

Dr. Stellwagen offered the following resolution: That all applause by stamping or clapping of hands during the session of this Association be considered out of order.

On motion, the resolution was laid on the table.

The selection of the place of meeting for the next session being now in order, the President appointed Drs. H. Morgan and A. W. Harlan, tellers. Boston, New York, Niagara Falls and Long Branch were nominated, and Boston was selected on the first ballot.

On motion, it was voted that members remain in their seats and vote open ballots, in order to save trouble to the tellers.

The election of officers was then proceeded with, resulting as follows:

President — L. D. SHEPARD.
First Vice-President — C. N. PEIRCE.
Second Vice-President — GEORGE L. FIELD.
Corresponding Secretary — M. H. WEBB.
Recording Secretary — GEORGE H. CUSHING.
Treasurer — W. H. GODDARD.
Executive Committee — J. N. CROUSE, C. S. STOCKTON, C. D. COOK; and to fill unexpired term of Dr. JUDD, W. C. BARRETT.

Association then adjourned to meet at 8:30 this evening.

THIRD DAY—EVENING SESSION.

Association convened at 8:30. President McKellops in the chair.

Miscellaneous business being in order, Dr. Atkinson moved that the Recording Secretary be instructed to open communication with all members of the Association in good standing, to ascertain upon which section they will elect to work, and to embody in his communication that unless a reply is received within twenty days from the time of writing, they will be assigned sections by the Secretary according to his option. Carried.

On motion of Dr. Spalding, it was voted that the sections meet for organization to-morrow morning at 9 o'clock, at this place.

On motion of Dr. Shepard, it was resolved that the several sections shall meet for the purpose of perfecting their reports as soon

after the organization of the Association — on the first day — as possible.

Dr. Hunt offered the following, which was lost:

Resolved, That the members of each section be required to place in the hands of the chairman of his section the result of any labors that may have been assigned to him, thirty days before the meeting of the Association.

On motion of Dr. Spalding, the following was adopted:

Resolved, That the reports of sections shall be called by the President in consecutive order, beginning each succeeding year one number higher than on the preceding year. Thus in 1879 the calling of sections began with No. 1. In 1880 it shall begin with No. 2 and end with No. 1, and so on.

Dr. Crouse, of the Executive Committee, made a statement of the financial condition of the Association, and suggested the taking of a voluntary contribution, which was done.

On motion, the Treasurer was instructed to notify absent members of this action and of the needs of the Association, and to solicit their aid.

The regular order was resumed, being the section on Operative Dentistry, and, on motion, this was passed.

Section 5 being called, Dr. Dean read a brief report on Physiology, and Dr. Werner made a verbal report on some physiological observations on the Action of Nitrous Oxide as an anesthetic. Discussed by Drs. Osmond, Peirce, Atkinson, Werner and Spalding.

Adjourned to meet at 10 o'clock A.M. to-morrow.

FOURTH DAY — MORNING SESSION.

The Association was called to order at 10:30 A.M. President McKellops in the chair.

The minutes of previous session were read and approved.

Upon motion, the newly elected officers were installed. Dr. McKellops made a few very happy remarks upon introducing the newly elected President, Dr. Shepard, which were as happily responded to by him.

Section 6 being called, and no report ready, it was, on motion, passed.

The following, offered by Dr. Stockton, were passed:

Resolved, That our thanks are tendered to our retiring officers for the efficient and courteous manner in which they have discharged their duties; also to our local committee, for the admirable manner in which they have performed the labor intrusted to them; also to the hotel proprietors, to railroad officials, for courtesies extended; to those who so generously came to our help by their volunteer contributions, and to the reporters of the press, for the excellent reports they have made.

The following, being the resolutions presented by Dr. Atkinson, and recommitted, were then adopted:

WHEREAS, This Association realizes the injury that is being done in foreign countries, by the *sale* of Medical and Dental Diplomas by one or two disreputable parties in America, to persons not entitled to receive the degree which these documents pretend to confer; and

WHEREAS, We are informed that in a recent pamphlet (1877), "A Book Reviewer," of Berlin, has endeavored to place the "Livingston University of America" (and some other institutions which, if they have any real existence, are equally unknown in this country) on a par with reputable Dental Colleges in Philadelphia; therefore, be it

Resolved, That we deplore the injury that has been done to the general profession abroad, and which this pamphlet may tend to increase; and that we will do all in our power to suppress the illegitimate traffic in Dental Diplomas, which degrades alike the profession in our own and in foreign lands.

Resolved, That we sympathize with any individuals who may have been aggrieved by the false statements, and with those reputable Dental Schools which have been misrepresented and defamed in the above-named pamphlet.

The following notice of amendments to the constitution was made by Dr. Spalding:

To amend third division of Section 6 of Article V by striking out the words "Nominations and." Also to amend the next paragraph of the same section so that it shall read as follows: The President shall appoint two members of this Association who shall act in conjunction with the Recording Secretary as the Publication Committee.

The chair appointed on Publication Committee, J. N. Crouse and Geo. W. Keely, and as local Committee of Arrangements Thos. Fillebrown, J. G. W. Werner and C. A. Brackett. The sections were reorganized as follows:

SECTION I. Artificial Dentistry, Metallurgy and Chemistry.—C. S. Stockton, Chairman; R. Finley Hunt, Eben M. Flagg, Henry Cowie, A. N. Priest, James Cleland, S. A. Freeman, M. L. Chaim, John Allen, Edgar Palmer, C. P. Pruyne, H. H. Keith, Chas. Welsh, J. F. Canine, J. W. Hall,

C. H. Harroun, H. W. Storer, A. E. Lyman, J. S. Cassidy, E. Honsinger, W. E. Hoag, D. C. Kelly, D. D. Smith, Merritt Wells, S. M. Cummins, J. Lathrop.

SECTION 2. Dental Education.—J. N. Crouse, Chairman; C. W. Spalding, C. N. Peirce, L. D. Shepard, C. J. Essig, T. C. Stellwagen, G. J. Friedrichs, H. A. Smith, K. B. Davis, Thos. Fillebrown, L. C. Ingersoll, C. D. Cook, D. C. McNaughton, W. H. Eames, A. M. Holmes, Chas. Merritt, H. B. Noble, H. L. Ambler, J. G. Templeton, E. S. Holmes, J. G. Harper, C. A. Kitchen, J. G. McMillen, Chas. Miller, E. Noyes, W. M. Reynolds, J. H. Smith, A. W. Smith, C. R. E. Koch, W. E. Magill, R. S. Rathbun.

SECTION 3. Dental Literature and Nomenclature.—W. H. Atkinson, Chairman; J. Taft, A. L. Northrop, F. A. Levy, J. N. Farrar, J. A. Stipp, H. L. Sage, C. A. Kingsbury, Wm. Jarvie, Jr., S. B. Brown, A. Colton, C. C. Chittenden, J. Hooper, J. G. Ambler, W. A. Bronson, D. W. Claney, Isaiah Forbes, J. S. Hill, F. A. Hunter, W. E. Riggs, J. C. Whinery, C. F. Wheeler.

SECTION 4. Operative Dentistry.—Geo. W. Keely, Chairman; H. J. McKellops, E. T. Darby, R. G. Richter, H. W. Morgan, G. W. Hoysradt, G. B. McDonald, J. C. Hanks, E. Osmond, W. H. Goddard, I. J. Wetherbee, W. C. Dyer, J. W. Rhone, A. H. Brockway, Jas. McManus, G. R. Thomas, L. G. Noel, W. H. Morgan, T. S. Hacker, C. J. Keely, John M. Hurtt, G. C. Daboll, C. R. Butler, George L. Field, S. H. Guilford, F. J. Richards, J. S. Swartley, G. W. Carman, L. D. Carpenter, Wm. Dutch, C. E. Frances, J. L. Clapp.

SECTION 5. Anatomy, Physiology, Histology, Microscopy and Etiology.—Geo. H. Cushing, Chairman; M. S. Dean, W. E. Page, J. G. W. Werner, M. H. Webb, Geo. F. Waters, Frank Abbott, W. H. Allen, C. F. W. Bödecker, G. V. Black, J. F. Marriner, W. C. Barrett, A. F. Emminger, Joshua Smith, E. S. Gaylord, W. W. Allport, S. W. Dennis, D. C. Hawxhurst, Wm. Taft, E. Hunter, E. D. Swain.

SECTION 6. Pathology, Therapeutics and Materia Medica.—F. M. Odell, Chairman; A. W. Harlan, C. S. Beck, M. F. Finley, G. W. Klump, C. A. Brackett, W. O. Kulp, E. A. Bogue, A. O. Rawls, W. N. Morrison, I. P. Wilson, C. H. Biddle, A. W. Freeman, H. H. Jackson, S. B. Palmer, F. H. Rehwinkel, C. E. Dunn, Oscar B. Doyle, I. Douglass, W. S. Moores, Gorton Nichols, Stoddard Driggs, T. W. Brophy.

Dr. Beck gave following notice of amendments to Constitution:

To amend Sec. 2 of Art. III of the Constitution by adding the words "or suspended," after the word "expelled," making the article read: Any member of this Association, being expelled or suspended from his local society, shall from that date cease to be a member of this body.

The minutes of the present session were then read and approved, and the Association adjourned to meet at Boston, on the first Tuesday in August, 1880.

In Memoriam.

JOHN H. McQUILLEN.

Your committee appointed to draft resolutions on the death of Dr. McQuillen beg leave to offer the following sentiment, which they believe will accord with the feelings of each member of this Association.

The Father of this Association has been called from labor to rest. Although we cannot see him by the use of our outward eyes, as present among us, beholding our good behavior, rejoicing in our progress, nevertheless, he doubtless is still with us in spirit and purpose, to assist in accomplishing the completion of the work so wisely begun by him while yet in the flesh among us. We mourn for ourselves in being deprived of his wise counsels and coöperation ; but we rejoice for him in that he is no longer amenable to the sorrows of misunderstandings and mental differences. May we all emulate his example of untiring effort for the upbuilding of our knowledge and efficiency in the great work for which this body was instituted! Though out of sight, still we feel him near to us all in harmonious fellowship in our work.

DR. REHWINKEL: I simply want to say that the kindly feeling and high appreciation of the members of the committee are shown in the phraseology of the sentiment presented. Their tribute is eloquent and beautiful, and I do not know that anything can be added to it; however, I want to say a few words. Any one who has known our departed colleague will know what a loss the dental profession has sustained. Those who had the honor to be called friends by him, will feel their bereavement to such an extent that language fails to express it. There was one touching allusion, in which it is said that our loss is his gain, that he is now relieved from all misunderstandings, all troubles and strife of life. I do not think, Mr. PRESIDENT, that there are many in the profession like Dr. McQUILLEN. There are few his equals, and still fewer his superiors; and I think we cannot express our sense of appre-

ciation of his merits, of his good, manly and generous qualities, in too strong and eloquent terms.

DR. BARRETT: It is when we come together in these meetings, and our minds begin to commingle, that we most keenly feel our loss. In the discussions of this morning it has come home to every one of us. There are times when certain special subjects are brought up for consideration, and we look around and unconsciously listen for the voice which we have so long been accustomed to hear, and we see — what?—a vacant seat; and then there comes to our hearts that indescribable yearning,— that passionate longing:

> "O, for the touch of a vanished hand,
> And the sound of a voice that is still."

DR. SPALDING: It is always sad to contemplate the death of a friend, and it is doubly so when we are brought face to face with the fact that our friend is dead. Dr. McQUILLEN was *one* of the founders, if not *the* founder, of this Association, and I believe I detract nothing from the just merits of any other member, living or dead, when I say that no one has labored more earnestly than he in bringing this Association to its present condition of usefulness. Now that he is absent, we can all the more readily estimate the value of his presence. Now that he will meet with us no more, we can the more fully appreciate the work that he has done. That we shall miss the courteous gentleman, whose face was ever robed in cheerfulness, I need not say. His place is henceforth vacant; we shall see him here no more. Yet we do not contemplate him as dead; we look upon him as still living. He has only trodden in advance the path that we, too, must soon follow. He has launched his bark upon that "mysterious sea whose waves have never borne the image" of a returning sail. He has "gone to the undiscovered country from whose bourne no traveler returns." But though he can never again be present in the body, may he not be near us in spirit? May not his strong love for this Association cause him to draw near to us at this time? Indeed, I almost feel as if the words to which I am now giving utterance, were suggested by his friendly presence! I almost feel, that when I take my seat, he will rise and say, "my friend from St. Louis is quite too partial in his praise; I have only done my duty." Let us then cherish the memory of his virtues, and embalm in our hearts the thought

that he is still one of us; that the separation that has taken place is only for a brief interval; that ere long we shall meet again.

DR. STELLWAGEN: Intimately associated as I was with Dr. McQUILLEN, from almost my very commencement in the study of dentistry, I suppose it would be my place here, under ordinary circumstances, and where only ordinary attachments had been formed, to speak. I took occasion, however, during his life, to show, as far as I was able, my appreciation of his work. I took occasion, during his life, to be worthy,—as far as I was able,— of his friendship, and I had it. Now that he has passed from our physical perception, it is not necessary to say anything more. I loved and I still love him. I ever shall delight in the remembrance of his regard and love for me. Dr. McQUILLEN lived for nothing but his profession and his family,— the most devoted, earnest, honest workman that we ever had in this profession. In the dental associations, in his college, in all of his various functions in connection with the profession, I do not think any one has ever excelled him.

My feelings will not permit me to bemoan in public a loss so great,—a loss to me so painful and so irreparable. My grief is too profound and poignant to vent itself in the conventionalities of words. My heart's emotions paralyze my tongue's attempts at utterance. I am dumb over the grave of this idol of my professional soul.

DR. BECK: I cannot allow myself to sit still and hear so much good spoken of my dear friend Dr. McQuillen without saying something, for I claim that I knew him better and longer than any gentleman in this room. Dr. McQuillen and I were students together. We came together hand to hand in the office of Dr. J. D. White, of Philadelphia. I loved him,—he was a noble-hearted man; his hand was always extended, his house was always open, and his friends ever welcome. Dr. McQuillen never felt better satisfied than when his friends were around him. I always found him a gentleman of honor whose word you could depend upon. He has done much for the dental profession. I assure you I appreciate all that has been said by the gentlemen who have preceded me. I think this society cannot do too much honor to our deceased brother's memory.

DR. ATKINSON: Our affections are touched by the passage of our friends out of sight. I do not regard Dr. McQuillen as dead

in thought, nor in his work and purpose of life; I think he is here, and that thought is not a degrading one to me. I loved him dearly, I loved his ambition, and as we all have differences with our dearest friends, so I had differences with him. We could not be individuals and have no differences; we could not have anything worth living for if we were all molded into one individual, continuous in personality. In reflecting upon this change that we have had presented to us as a dreadful thing, I shall but give a little different direction to our reflections, as they were foreshadowed in the few words in the resolution presented to this body, in saying that "he is not dead but sleepeth"; and that he will coincide with us in spirit, in purpose and efficiency, just so far as we utilize the light that he threw upon our pathway. May we all be as earnest and as persistent in discharging the duties that lie upon our consciences as he was, is the prayer of my heart for us all.

PRESIDENT'S ADDRESS.

H. J. McKELLOPS.

GENTLEMEN OF THE AMERICAN DENTAL ASSOCIATION: We are now assembled for the purpose of holding the nineteenth annual meeting of this Association; we come together at these stated gatherings with the intent of laying upon the common altar of the profession the results of our labors for the year that is past.

In opening in a somewhat formal manner the proceedings of this meeting, I have ventured to deviate in some degree from the usual custom by laying before you a few suggestions that appear to me to deserve your earnest consideration.

Soon after the close of the last meeting several of the papers read at that time appeared in the medical and dental journals in advance of the publication of the annual volume of transactions. Heretofore all papers read before this body have been regarded as the exclusive property of the Association; yet, in the absence of any rule of the Association governing the subject, no restriction has been placed upon the authors of such papers to prevent the use of duplicate copies. It seems desirable that the Association should adopt some rule controlling the disposition of all papers read at its meetings in the future, else the transactions will lose much of their present value. A wider distribution of these volumes seems also desirable, and a suggestion of the Recording Secretary that copies be furnished to public libraries meets with my hearty approval.

There are now in existence three general bodies composed of members of our profession, each claiming national characteristics. The oldest is the American Dental Convention. This body, the American Dental Association, ranks next in point of age, and the youngest of the three is the National (late Southern) Dental Association. This division of our forces into three parts has a tendency to diminish the benefits which would result from a concentration of the entire strength of the profession in one truly national body. This subject seems worthy of your particular consideration at this time.

Larger provision has been made this year for the display of instruments, materials and appliances than has been heretofore provided. Encouragement should be given to this branch, as it comprises its chief exhibition, and inducements should be held out to manufacturers and inventors to bring their products to our meetings, that a knowledge of all improvements may be generally disseminated. The dental periodical and the secular press would probably aid in this work.

I would also suggest that some systematic effort be made to provide reports of our proceedings for the daily papers in all the large cities of the country. A knowledge of the existence of this organization and of the works in which it is engaged, would thus be brought into popular notice. In conclusion, gentlemen, it becomes my painful duty to speak of the decease, since our last meeting, of one of the original members of this Association, one who has ever manifested a deep interest in its proceedings and who has largely contributed to its success. I allude to Dr. John H. McQuillen, whose death attracted the attention of the dental profession both in this country and in Europe. It is not my purpose to attempt any eulogy of that distinguished gentleman, but only in my official capacity to call attention to the loss which this society and the profession at large have sustained in his death.

LETTER FROM DR. GEORGE WATT.

To the President of the American Dental Association:

DEAR SIR,— Allow me to address you, and through you my brethren of the American Dental Association. Will you kindly allow the address to be personal as well as peculiar. I am laid on the shelf, and the front of the shelf is being turned upward, turning me to the wall and shutting me from your sight, and, worse still, shutting you from mine. I thought I was reconciled to the position, and said so; but all these years I have indulged the fond hope that once more I would be able to meet with our beloved Association and take a farewell look at your familiar faces, and the fresh blasting of this hope has told me how much mistaken, how unreconciled, I am. Hence this wail; for though the judgment is able to say: "Even so, Father, thy will be done," the heart shrieks at every blow. I would not have you think of me as morose or melancholy. With cheerful countenance I am struggling for — *breath* as diligently as ever I labored for the advancement of professional knowledge, and am sorry that my success in this is but little if any better than in that. Of course, if with you now, I would see many strange faces, and even those familiar ones changed by the touch of time. The younger members, some of them pupils of my pupils,— perhaps a large majority of members present — have not even heard my name, though to me it seems but yesterday that I was an active, honored, or at any rate petted member of the Association. "Backward! turn backward, O Time, thy flight." But no! onward and upward must be my watchwords, as they express the hopes and aims of our beloved Association. I say *our*, for though on the shelf, I feel that I am still one with you, and I hold a delegate's certificate, which of course I cannot use, as this is written from a sick bed.

A word for the past: When I came from the medical to the dental profession, I was received with open arms. Opportunities for usefulness unsought presented themselves. Positions of responsibility and trust were freely offered, indeed I may truly say

thrust themselves on me. Acceptance of these involved sacrifices, both vital and financial. How faithful to these trusts I proved only your older members can judge. Much that I said should have been left unsaid. The same is true to a less extent, perhaps, of what I have written. It is a pleasure now to remember that all was written with the kindliest feeling, except a single short and unimportant paragraph. Some of my written articles received more attention than they merited. One or two, I think, received less. The Thoughts on Caries (see "Chemical Essays," or Appendix to Taft's Operative Dentistry) resulted from long, severe study, laborious research, prolonged and expensive experiments in and out of the mouth, and the conclusions were not hastily drawn, and I confidently believe will stand the test of time; and yet, I am sorry to say, very many of you in speaking of dental caries confound predisposing with the immediate causes as though the articles had never been written. I regard these articles, in reference to caries, as capable of being more useful than any others I have written, but their practical application requires some thought on the part of the reader, leading out in the direction of dietetics and general hygiene.

The article on Topical Remedies, read at Hope Chapel, New York, in 1856, was the most carefully written of all my essays. Two weeks' investigation and experiment were sometimes necessary before a sentence begun could be finished, and the reception awarded it should assure young writers that carefully matured thought will be duly appreciated. It was published in the "Dental Register" and copied by all the dental journals in the world.

Many years ago I began a series of researches, observations and experiments in reference to the deposition of tartar or salivary calculus. These have been continued, as health would permit, to the present time. They are by far the most important and the most satisfactory researches I have ever made. I have not been able to set them before the profession in writing, but have endeavored, at some of the meetings of the Ohio State Dental Society, to give a verbal account of them. But in the hurry of debate, important ideas often fail to be caught by the hearers, and some of you know that even "verbatim reporters" fail to take me. Hence I feel that my views on the subject are not before the profession, though I hope I may be spared to yet write them out. Indeed,

it was my earnest hope to be able to give them to this meeting of our association, as I was earnestly requested to do by my friend Dr. F. H. Rehwinkel, of the department of pathology. But since February I have been too much prostrated, this gossip being no evidence of ability for close thought. But should I be able, hereafter, to give both the general and special pathology present in the condition spoken of, and to suggest treatment, both preventive and curative, at the same time arresting the tendency to white decay, let no one look for a nostrum or a recipe, or anything that will obviate the necessity for brains on the part of the practitioner, as a substitute for the human brain is not yet developed. But this must close; only a page was intended, but the pencil wouldn't stop. It seemed to forget what a feeble hand was behind it. One page would not have exposed so much weakness, nor so much egotism. But why not egotism? I write this. I would like to see you all. I pine for your society, and your individual friendly grasps. I wish you and the Association long life and prosperity. I am distressed that I can't be with you, and therefore I write. I am sorry, and want to say so. *Egotism?*—of course!

And now, Mr. President, I do not intend this for any part of the proceedings of the Association, but when you read it you may tell the brethren about it, or let them read it, or any way to establish or continue a bond of sympathy between them and me. As I am unable to keep up a private correspondence with my brethren, I am become very lonely.

With best wishes for you all, I am, as ever, your friend,

GEO. WATT.

XENIA, OHIO, July 28, 1879.

REPLY.

LANCASTER, PA., August 21, 1879.

PROF. GEO. WATT:

Dear Doctor,—Your letter to Dr. H. J. McKellops, President of the American Dental Association, was read before that body by the Recording Secretary, Dr. G. H. Cushing, and a resolution was passed instructing the Corresponding Secretary to reply to your communication.

I, as Corresponding Secretary, would therefore state that your very kind letter was attentively listened to, awakened the most kindly feelings, and all deeply regretted your absence.

All were very sorry to learn of your illness, but entertained the hope that so valuable a life as yours may be spared for years to come. We are all fully conscious of how you have labored for professional advancement, and I assure you that your presence and counsel is missed at the meetings of the American Dental Association. If all those who now attend the meetings of this Association do not know you personally, surely they must have heard of, even if they have not read, "Watt's Chemical Essays," and other writings — essays of so high a value. May you be spared to yet write out your researches, observations, and experiments, in reference to the deposition of tartar or salivary calculus, is also (I feel assured) the prayer of not only every member of the American Dental Association, but of all those interested in science. They would further pray that you be spared much longer than that. I assure you that there is a bond of sympathy between the members of the American Dental Association and yourself; they certainly feel like turning down the shelf upon which (as you inform us) you are laid, and doing all in their power to raise you with a strong arm upon the five points of fellowship; to call you "from labor to refreshment,"— from sickness to health.

As every member of the American Dental Association would say, so will I write, Very truly your friend,

MARSHALL H. WEBB,
Cor. Sec'y American Dental Association.

REPORT OF SECTION ONE

ON

ARTIFICIAL DENTISTRY, CHEMISTRY AND METALLURGY.

By R. FINLEY HUNT, Chairman.

SECTION ONE, having charge of "Artificial Dentistry, Chemistry and Metallurgy," respectfully report that circumstances beyond the control of its members have prevented their doing more at this time than simply to report progress.

In view of the number of subjects committed to it, — the importance of each one of which might well entitle it to the undivided attention of an entire Section, — of the small number composing this Section, of the short available time since the last meeting and of the preoccupation of the chairman in a work that has been the absorbing duty of his life for three years last past, — it has been impossible for the Section to make to this meeting a report, entering into the discussion of these subjects, that would at all do justice to the subjects, the Association or the Section.

DISCUSSIONS.

Dr. Taft: I hope something will be said upon this subject. The criticism has been made here that the subject of Mechanical Dentistry is usually passed by, no opportunity being afforded to those who are more especially interested in this branch to consider it. The opportunity is now afforded to all such, and I hope they will improve it.

Dr. Stockton: I do not know that there has been anything new brought out during the year in regard to Mechanical Den-

tistry. The same materials are used; the same manner of constructing artificial dentures is still carried on.

I think there is nothing so good for partial plates as gold. For whole plates for the lower jaw continuous gum is the best, while gold for upper sets, fastened with rubber or celluloid, is very desirable. I mention this last because you can thus have a cleaner denture than you can where the teeth are soldered on; although the strongest and best possible work that can be made, in my judgment, is a good gold plate with single teeth soldered on. You can pack rubber in the interstices, and make it clean in that way. When rubber is done away with dentists will be better qualified to practice dentistry as it was practiced years ago. The proper instructions to students are not now given by preceptors, and I think not in colleges, judging from the fact that I see no sets of teeth that are ground up and fitted to the plate as they should be. My practice generally is to take the impression immediately after extraction, and put in a set on celluloid, allowing them to be worn as long as they can be comfortably, and then, if necessary, before the alveolus is absorbed sufficiently for the permanent set, to make them over again. When the time comes I tell my patients that it will be cheaper for them, in health, in comfort and in the pocket, to have a good set of teeth made on gold than on anything else.

I do not want dentistry divided; I want it to remain in its entirety. I do not want, as Dr. Marvin calls it, "fractional dentists." I want the young men who come into dentistry to know the thing from beginning to end. I want them to know how to take the gold or silver coin and from that to make the plate. I want them to know how to make teeth as well. Only a short time since I had a very difficult case indeed, and there was only one gentleman that I could find who could carve me a block for it. I could have done it myself, but two years ago my old furnace gave out, and I did not care to get a new one specially for that purpose. But I claim that every dentist should know how to construct a piece of artificial work from the earliest step to the last.

Dr. Atkinson: My efforts in endeavoring to get this Association organized into permanent sections were for the express purpose of dividing the labor of the body, allowing members to elect in what sections they would work so that the sections might elaborate reports that should be a guide to all who needed a

guide in the direction in which the section had charge. I did not hope that we would start off in the new order with the same celerity and vim that we had pursued in the old method.

I wish now to say a few words respecting the necessity of artificial teeth, and make reference to a few great regrets for the lack of knowledge on the part of those who extract teeth in this country. Anæsthetics of all kinds, nitrous oxide par excellence, are Satan's right hand men, and the agents that use them are the lieutenants that go forward to the reckless work that pains every man of any conscience that belongs to the profession.

Mechanical Dentistry was started upon false principles, upon lack of knowledge of the anatomy of the human jaws and teeth, and an entire misconception of the use of the roots of the teeth. No anatomist will extract healthy roots of teeth, whether they have crowns on them or not. The teeth were put there for the purpose of distributing masticatory force, that food might be properly prepared for the processes of digestion. Who has stood forth and preached that doctrine? Who has practiced that in his life? One half of one per cent of those practicing dentistry would embrace all that have practiced correctly in that direction. We have establishments in the city of New York based upon the idea of cheap artificial teeth being of more value than sound natural teeth, and I have patients under surgical treatment now, where the money had been taken, nitrous oxide administered, teeth crushed off and the roots left in, and the patients came to me to extract the roots. In the last case I refused to extract the roots on the ground that I have already hinted. We must take a new departure or we shall not be a scientific body of practitioners of the art of dentistry, and we must know the basis upon which the art is built. That is the reason why I commended Dr. Dean's remarks respecting the rights of the Sections, according to the organic law that originated them. The Sections are to be the judges when they have anything fit to be presented to this body, and they do not need to ask the vote of this body for further time or anything of the sort. They are independent in that respect, and if they have nothing but a report of progress to make, all they have to do is to make it and we have to accept it, and we are glad to accept it, if in their judgment they have nothing fit to give,—why shall we spend our time at it? Maybe you think it is not worth your while

to listen to these remarks, but I tell you if you are fit to practice dentistry you will see the relevancy of what I have said, and you will see the imperative necessity of our crying out against this ruthless wickedness, this savagery, this abominable butchery that is going on throughout the land. I will instance the case of a young lady who is making her living by her needle, without mentioning any names; but if it becomes necessary I can give names, and if I am confronted, and it denied, I will do so and prove what I say. Calling upon an administrator of nitrous oxide gas to have a single tooth extracted, there were fifteen extracted, the majority of which were sound, and she paid sixteen dollars for the extracting of those teeth; and afterward called upon a friend of mine to have the teeth inserted upon some artificial base. The gentleman, who is a christian and an A-number-one dentist, gave her the work at cost, and she is now in a mutilated condition on account of the ignorance and wickedness, or the ignorance or wickedness, of the person administering the gas and extracting the teeth. The lady who employed the girl, and the girl herself, said they did not want the teeth extracted, and after she came to, remonstrated against the ruthlessness of the removal of excellent teeth in her mouth; and was assured that the best thing that dentistry could do for her was to take her teeth out, though they were sound, and give her a good artificial set of teeth that would not ache. That is what Cheap John dentistry is doing all over the country, and who that has a soul, who that has an intellect, who that has a friend on earth or in heaven, would not pray that some arm might stay such wickedness. But Oh, the dear people, the dear people will have it so! The old book says, "My people love to have it so." They do not love to have it so, but their ignorance has uneducated them so that they do not see anything but what the Cheap John sees, the way to get an unclean dollar on his part, and the way to get an unclean piece of work for a very few dollars on their part; and thus they are going through life crippled and mutilated and unfit to be representatives of the human family and progenitors of a race. If we succeed in accomplishing the work that has been laid out in organizing this body into permanent sections, we shall establish such scientific information as shall let all the people know that a natural tooth is worth more than all the artificial teeth that were ever made; and that we need

whole systems to perform the functions of the body that they may be acceptable, that we may live and enjoy life and be the means of blessing each other in all our intercourse in life. That is what I think about artificial dentistry.

One word or two respecting something that is in preparation. There is some experimenting going on with the hope of casting gold plates so as to be perfectly air and moisture tight to the teeth for artificial dentures, something after the manner of the well known cheoplasty of A. A. Blandy of years gone by. My own impression is that they will, for partial purposes, succeed very well, and I do not know but for entire sets; but I am not so anxious to teach people how to redeem their fellow-men from mischiefs already incurred as to teach them how to avoid the necessity of redemption, to live according to the laws of hygiene, of morality, of fraternity, kindly and honestly, that we may do good by rule, and mischief only by chance and by exception, rather than going on as it is now in artificial dentistry, doing mischief by rule and doing good by chance.

Dr. Essig: I agree with Dr. Stockton that every dentist should be a full dentist, and understand thoroughly every branch of his profession, and I also agree with Dr. Atkinson that there are too many teeth extracted, and that mechanical dentistry is very greatly abused. I appreciate the importance of this matter in this connection because in my experience with students it is not an uncommon thing to have a man present himself and tell you in the very beginning, after asking advice as to the course to pursue in his studies, that he desires to devote his attention exclusively to filling teeth with gold. On one occasion when this happened, I was told by the gentleman that he did not wish to devote any time to laboratory work, he did not want to make its acquaintance; and after he got through I asked him what he meant to do with those cases in which teeth were lost from other causes than that of decay, as from absorption or caries of the alveolus, and he seemed quite puzzled. There is one matter to be looked squarely in the face, and it is that there are other causes for the loss of the teeth less amenable to treatment than caries. The natural organs will be lost, and artificial substitutes must be introduced in their places, and those substitutes must be made accurately and carefully to be useful and serve the purposes of

the natural organs; and, therefore, artificial dentistry cannot be ignored, and ought not to be passed by, as it seems to me in danger of being this evening.

With regard to roots remaining in the mouth, I will simply say that it can be done in many cases. It would be very desirable if some firm foundation could be formed, but we must bear in mind that the artificial denture in many cases is retained in its place by atmospheric adhesion. To secure this there must be some elasticity, and if the substance on which the plate rests is not elastic, there will be no atmospheric adhesion, and the teeth will be practically useless.

Dr. Atkinson refers to some prospective improvement in casting plates. Twelve years ago Dr. Bean, of Baltimore, who was then experimenting with his aluminium plates, told me it would be quite as easy to cast a gold or silver plate as one of aluminium. The specific gravity of gold or silver being so much greater than aluminium, the probabilities were that there would be less difficulty in the metal finding its way into every part of the matrix than was the case with the lighter metal aluminium. Dr. Bean's process was a very beautiful one, and it was very successful as far as the method of making went, but it was one that very few men could accomplish on account of the difficulty of the manipulation and the care that was required. It would be very much easier to swage a plate, and any skillful man who knows anything about that branch of his profession can swage a plate to fit just as perfectly as one made by casting. I see my friend Atkinson shaking his head negatively, but there is one matter that he seems to forget: a plate that is cast must be the size of the plaster model. The plaster model is always larger than the mouth. Every one knows that a plate that is made to fit exactly upon the plaster model must be a little larger than the mouth, and that is an element of trouble at once. A plate should be somewhat smaller than the mouth to compensate for the depression of the capillaries and the change and absorption that takes place along the ridge. By way of illustration, if a plate be made to fit the cast perfectly, and be then introduced into the mouth, it will, in the course of a few days, be found to press a little hard upon the roof of the mouth, and not so hard upon the ridge. That is wrong, it should press in the first place a little unduly along the

ridge, and should be a little loose at the palatine arch, for the certainty is that it will in a few days adapt itself to the ridge, while the palatine arch is stable.

That is the result of the experience of everybody, I think, who has watched the matter closely.

DR. STELLWAGEN: My object in taking the floor is to call attention to a method of adapting metallic plates to the cast of the mouth, which seems to be known to but few. It was first, as far as I am aware, attempted by my friend and student Dr. M. H. Cryer, of Philadelphia; and I think that by this method we have had some of the most wonderfully successful adaptations of plates to the mouth that I have ever seen. All who have swaged plates know that sometimes the counter die is beaten out of shape, the plate stretches at one point or more, making it thinner and larger at these points. In order to avoid this distortion of the plate, Dr. Cryer devised the plan of squeezing it between the two dies by means of a screw. I would recommend those who are interested to give it a practical trial. I am not prepared exactly to explain the weight and size of the screw, but know that the earlier trials were with one arranged for celluloid work. It was broken several times, but was strengthened by means of screw bolts and nuts, with heavier plates and a longer lever put in. The same apparatus is still in use in the doctor's laboratory. It has the effect of gradually coaxing and pressing the plate into the shape desired.

DR. BUTLER: I have a few words to offer upon the manner of swaging metal plates. Professor Stellwagen has referred to a gentleman in Philadelphia pursuing the plan of raising them by pressure, or by press-work. It is contrary to all accepted and practiced modes of raising metals into irregular forms. The idea is that you may avoid the stretching of the plate irregularly, thus producing an imperfect adaptation. The plan of casting has been referred to. I have some doubts about it being ever practicable, as the manipulations must be carried through so very nicely that there are few that will give it that attention that would be required to make it a success. All workers in jewelry construct their irregular forms by what is called a drop-press, and not by screw pressure at all. The most perfect adaptation to the die that is possible to be made is made in that manner. You cannot coax metal into irreg-

ular forms in that way so completely as you can by the generally accepted one. Plates, whether of gold or platinum, can be swaged into shape with very much less force than is ordinarily applied, and the expansion of the plaster model is compensated for by the shrinkage of the zinc die; and the simple stretching of the lead, if the zinc is of sufficient depth to give it strength, so that it won't give, is of no practical objection.

After a moderate amount of force has been put upon the die, and you find that the lead is being stretched, it can be easily driven up by simply holding the die in the hand and driving around upon it, carrying the gold with the lead down more perfectly and with less stretching into the irregular shapes than you can by the screw process. With reference to the subject of Artificial Dentures, as a whole, for some reason it has seemed to have had very little attention for some years past, and it is a thing that we cannot do without. Perhaps we may outlive the great demand that now exists, but at present there are millions that demand these things at our hands, and we should be able to meet that demand in the best manner. That is the point; and if, as Dr. Stockton says, we are not able to do it with our own hands, we should at least be able to give the proper instruction for some one else to do it for us. There are many of us who do not know how to give the proper instructions to a workman to raise plates for us. There are some cases where it is impossible for the mere mechanic or artisan to do it. There are certain features about such cases that make it imperative that we should be able to do the work ourselves in order that we may obtain the best possible results.

Dr. Rehwinkel: This discussion would not be complete if nothing were said about warped and twisted plates. It has cost me many dollars and a great many speculations about its possible cause, and I was perhaps accidentally led into the way which I thought put me upon the right track. We know that the old Mexican dollars were always considered very fine coins for mechanical use. You would sometimes find one which was all right, and would work very well. Again you would get one, one-half of which would work well, and the other half would be stubborn and rebellious under the process of swaging. What was the cause of this difference? Evidently a carelessness in alloying the metal. A five-franc piece, no matter of what coinage it may be, will always

work with greater uniformity than any of the former coins,—a fact which I attribute to the greater art of the mechanic in alloying the metal. Having observed this, I was led to inquire whether the warping of plates was not frequently caused by the imperfect manner of alloying. A good many dentists who are able to work metal at all will recollect that it was sometimes a good half day's work to refine a lump of gold which was very impure, to bring it into condition so that it would work at all. Now, by frequent melting the alloying becomes perfect.

I want to allude to a process of overcoming the heating which celluloid or rubber plates occasion in the mouth, producing uncomfortable sensations; and that is, lining the plates with a thin plate of gold. On the outside there is an attachment with a very narrow strip of platinum twisted up in the shape of a spiral spring and brought out into a coil. It is simply put around the edge, so that the rubber will embrace it and become thoroughly and firmly attached all around the edge. In vulcanite or celluloid the plate is put over the model and pressed into the matrix. You will find that this device will do away with the tendency to sore mouth and remedy the difficulty where a trouble of that kind does exist; at least it has succeeded with me in three very marked cases.

DR. MCDONALD: In my early practice I had considerable difficulty in the warping of metal plates. In looking around for an explanation, it seemed to me to be caused by having too much alloy either in silver or gold, or by using too large quantities of solder. I discovered it was better to have pure silver and no alloy. I was taught that 22 karat gold was too soft to make a dental plate, or that it would bend in use. My experience does not sustain this doctrine, and for many years I have made all of my plates of 22 karat gold, using American coin, and I have had no trouble from warping, either after they were swaged, in annealing them, or in soldering on the teeth, and I do not recollect a case that bent afterward.

DR. STOCKTON: With reference to what Dr. Stellwagen has said, the shaping of plates by means of screwing dies together does very nicely, saving much trouble; but when everything is done with the screw, then you want one or two sharp, hard blows to send the thing home; 20 karat gold, with 18 karat solder is the material of which to make plates. I intended to

have said before, if you have only one good root left in the lower jaw, do all you can to save it. Place upon it a crown, the best way you know how, and it is worth hundreds of dollars to the wearer in steadying and supporting the artificial denture.

DR. ESSIG: I simply want to say a few words concerning the point which Dr. Rehwinkel mentioned, and that is the tendency on the part of the constituents of alloys to separate when in the fused state. Between certain metals this tendency exists to a considerable extent, for instance between tin and platinum, or between silver and platinum, and also between silver and copper. Between silver and copper the tendency is so great that, at a certain temperature after the two are melted together and perfectly incorporated, the copper will separate from the silver and form a different alloy of its own. Sometimes it is perceptible; take an ingot of silver and it will be observed that veins of it are somewhat red in color. Of course this would be a good reason for the warping of the plate. I also want to refer to the press that Dr. Stellwagen spoke of in his remarks. Any one that desires to test the relative effect of persistent force and percussive force can do it by attempting to swage a plate of iridiumized platinum or iridiumized gold. It will be found impossible to swage a plate properly by persistent force, but it will be found comparatively easy to effect it by percussive force; I mean by the use of a hammer.

DR. STELLWAGEN: I am not certain but that Dr. Cryer may strike a blow at the last part of the adaptation of the plate, but getting the plate down to that point where the blow tells uniformly, is effected by the screw.

DR. CROUSE: There is another process in artificial dentistry which has not been spoken of here, which I think well of, and those who have used it more than I have think more of it than I do, perhaps; this is the setting of artificial gold crowns upon roots,— a method introduced into this part of the country by Dr. Richmond, of California. I have been surprised in a number of cases, upon an examination of them, to see how beautifully they work. I was very much prejudiced against the idea of driving gold around the necks of the teeth, supposing it would keep up an irritation; but those who have used it most assure me that it does not, and from my observation I think there is very little

objection to it on that account. I had the pleasure of examining, a few days ago, an operation of that kind, where a gentleman had placed a gold crown upon a front tooth, and had attached to it an artificial tooth to fill the space adjoining, where there was no root, and it was working beautifully; so that it looked as though it was going to be a success, the root supporting the gold crown and the tooth attached. I have been speaking to some gentlemen since I have been here who have set a great many of them, and all seem to be much pleased with the operation.

DR. TAFT: I greatly desire that something might be done, either by law or some other way, to arrest the wholesale slaughter of teeth that prevails to such an alarming extent. This abuse has come in like a flood since the indiscriminate use of anæsthetics. In every city there are places where they make extraction of teeth a business. They not only remove teeth that ought to be removed, but often a great many that ought not to be removed. I sometimes have occasion to get teeth from these offices for the use of students, and I am pained and surprised to see how many of them might have been retained and made serviceable for many years. Judging from appearances, I should say that from two-thirds to three-fourths were such teeth as dentists are in the habit of saving,—just such as many of you have treated ten, fifteen and twenty years ago, that are to-day serving all the purposes of the natural teeth just as well as they ever did. There should be some way of arresting this practice. If the states that are enacting laws against empyricism could bring legal enactments to bear upon this practice with crushing weight, a great benefit would be wrought for the public, and for the dental profession as well. Every man who indiscriminately takes out teeth is a criminal, and ought to be punished.

The preservation of the roots of teeth I regard as a very important matter in many instances, and in practice I have retained and preserved all roots that were in any way valuable. In the extraction of teeth, and even in the removal of roots of teeth, the dentist should be put upon the same plane with the surgeon, and it should be no more lawful for him to remove a tooth from the mouth that might by skillful treatment be made serviceable, than for the surgeon to take off a hand that could be preserved and made an useful member. What would we think of the surgeon

who would take off every finger, every hand that might have inflammation, that might have an abscess, every toe that had a corn upon it, every nose that had pustules upon it! Would there not be just as much propriety in doing that as there is in taking out all slightly diseased teeth, or such roots of teeth as can be retained in the mouth in a state of health and be useful to the possessor? Roots of teeth treated twenty years ago or more are to-day just as comfortable and serviceable as they were then, and so I hesitate to take out roots of teeth. Whether plates are to be inserted or not over the roots, they may be made serviceable. It saves mutilation of the features, which necessarily occurs in every instance where the roots are taken away; and when the symmetry of the face is destroyed it can never be restored. This is the rule; there may be exceptions.

A method of supplying artificial crowns upon the roots of all the teeth, even those of bicuspids and molars, has been devised by Dr. Peabody, of Louisville, Kentucky. For this method the tube teeth made by C. Ash & Sons, of London, are used. The root is dressed as usual for inserting a pivot crown. The crown is then fitted upon it and articulated with the antagonizing teeth. Then open and enlarge the canal, or canals. If a molar or bicuspid, enlarge and form these so they will receive a staple from one and a half to two lines in length, made of No. 16 to 18 platinum wire, Stubs' gauge. On the bow of this staple solder a platinum wire long enough to reach through the tube in the crown, and large enough to fill the tube. On the free end of this wire a screw should be cut and a nut fitted. This tube in the crown surface of the tooth should be counter-sunk to receive the nut quite below the surface.

The root and staple prepared, the latter is properly adjusted in the former, so as to bring the crown in the proper position, and fastened by filling round it with gold, amalgam, or any practicable material. This being done, if a plastic material is used, sufficient time should be allowed for it to harden before putting on the crown, or at least before fastening it. When this is done the crown is fixed in position with the nut already mentioned. This nut should be covered by a filling of gold.

For a tooth with a single root, a straight rod with a screw upon it by which it may be fastened into the root will take the place of

the staple. In other respects the mode of procedure is the same as that already described.

This is a very good and practicable method of setting artificial crowns of teeth. Dr. Peabody informed me some time in June last that he had practiced this method the last three or four years, and that it was thus far eminently successful.

DR. MCDONALD: I wish to indorse everything that Dr. Taft has said. I say with him, what can we do? I ask you as a profession who desire to save natural teeth, shall we hold out the right hand of fellowship to such men when we know they are murdering those teeth every day? Dr. Taft says they are robbers, and still we meet with these gentlemen, and extend to them the right hand of fellowship. Whenever I put my eye on one of those men I say to myself, and I cannot help saying it, you are a fiend; you are working for the purpose of making filthy lucre by destroying your race and making their days shorter; and I say the first thing we must do is to ignore all these men.

DR. CLUMP: I rise to indorse all that has been said in regard to the indiscriminate extraction of teeth. The practice is not confined to large cities. There are men who travel around from house to house and from door to door soliciting patronage who do this. It is not necessary to make any extended remarks in this direction, but there ought to be some way to stop it.

DR. BARRETT: I wish to know if in those states where they have good and sufficient legislation, where the profession is thoroughly organized, it is not possible for the profession itself to prosecute such men for malpractice? We denounce these things, these Colton institutions, when we get together by ourselves, but when we get home some of us will send patients to these very places. With a great air we boast that we extract no teeth, and then whip the old boy around the stump by referring our patients to these butcher shops. How many men of those who are called first-class practitioners in the city of New York send their patients to just such places as these, and how much better are they than if they did the same disreputable work in their own offices? In my own city I know a case where there were two decayed bicuspids, one upon each side, and the patient went to one of these places to have them removed. An anæsthetic was administered, and when she recovered she found they had begun with the bicuspid on one

side, the least decayed of the two, and had gone clear back and extracted the last molar tooth, and were commencing on the other side. She left the place, having paid very dear for a lesson that might have been learned by proxy. That man was guilty of malpractice, and if I had done my duty I would have strongly advised her to sue him for damages. The great trouble is that usually such men are not responsible, and you have your own costs to pay.

DR. HUNTER: I indorse what has been said with reference to the indiscriminate extraction of teeth, and saving all teeth that can be saved; but gentlemen have advised doing something about it, and the question is, what is to be done? How can the people be educated properly upon these subjects, and dentists be influenced to do right, and thus remedy what is complained of? People are in the habit of going to dentists and dictating what they shall do, just as they go to a mechanic and dictate to him what they would have done to their machine, boot or shoe; and, if they are told that that is not the proper thing to do, and you cannot do it, they will say I will go to somebody that will do it. It was for the purpose of information that I came to this Dental Association, and I have been greatly benefited by attending this and our State Dental Association, and I hope to continue to be benefited and stimulated to higher and better attainments, the better to serve my patrons. I find that there is a great deal that you call malpractice, and I find myself sometimes very much puzzled to know what to do with the patients before me, because I cannot influence them to have done what it seems to me proper to be done.

There is quite a large number of practitioners in large cities that have made reputations and receive patronage mostly from the wealthy classes, that can and wish to pay for nothing but the best, and people come to know that what they have such men do must be done in accordance with their standard of operating and practice, and do not attempt to dictate their manner of operating; or, if they do, very soon find that they have made a mistake. There is another class of people that never patronize the best dentists in these same cities because they cannot afford to pay high fees, and seek the services of a cheaper and inferior practitioner, and dictate how their work shall be done, and manipulate prices somewhat to their liking.

There is, I believe, a larger proportion of the latter class of persons seeking dental operations in smaller cities and country towns than in large ones. In very many instances the conscientious practitioner may be able to successfully advise persons in small towns, but in more instances he would meet with—if you won't do what I want done I will go where I can get it done. And the dentist is many times constrained to yield his judgment and do the work because he believes he can do them better service than they will receive if he lets them go to his competitor. And then he feels that he cannot afford to let all such patronage go from him.

DR. THOMAS: I have advocated for some time, as some of you perhaps know (and the more I hear this matter discussed the more thoroughly I am convinced that I am right), that the only thing we can do, is to cut ourselves off from this *business* of making artificial teeth. Mechanical dentistry has got such a hold upon the people at large that all the discussion that can be had, in bodies of this kind, cannot affect the men that are doing this kind of work. Dr. Taft says, "bring them up before the law and prosecute them." I would ask Dr. Taft, where can we find a judge or a jury competent to decide as to whether they were guilty or not, as the errors of the ignorant physician are covered by the grave, so the works of the unscrupulous tooth-puller are hidden by the use of the forceps. The thing cannot be done in that way; and therefore I say it is the business of the dentist to hold out the inducement to the public that his *only* business is treatment of the natural organs. One gentleman has said that "we fraternize with these men." So we do, more or less, and so we must, and we acknowledge them, in a measure, as dentists.

The matter of gold crowns has been spoken of. A great deal more can be accomplished by that kind of treatment than some may believe. The mode that was introduced by Dr. Richmond meets a want that it seems to me we all ought to know more about. As Dr. Crouse has said, when I first saw the work I was prejudiced against it, thinking it would cause absorption, and that there would be constant trouble. I had one put upon a molar in my own mouth, that I must say has more than satisfied me. I know no difference between it and any of my good teeth that are healthy. That gold, as you all know, is driven *over* the root so

that there is no chance for any secretions to get in at all. I have set several of these gold crowns, and they have more than met my expectations. It seems to me if we give our attention to this matter of saving teeth, in some such way, we can avoid the manufacture of so much artificial work as is demanded at the present time. We have got to do something, and the only thing we can do is to lessen the demand for that kind of work.

DR. BOGUE: If you cannot get hold of them by law, perhaps you can by gospel. There has been an effort made to indoctrinate the people into those things which go to make up a perfect denture well cared for. I would like to inquire what state there is that has not a dental law.

DR. TAFT: I had reference only to the laws that are in existence in several states bearing upon the subject of malpractice.

DR. FRIEDRICHS: There is a law of that kind in Louisiana, and I know of a case where a gentleman recovered five hundred dollars for the loss of a tooth. This, however, was not a case of malpractice, as the tooth was knocked out in an assault.

DR. BOGUE: With a view to making a reply to something that was said by Dr. Barrett. He asks, "who refers patients to such men as those who keep dental slaughter houses?" I do. "Who will do it again when he goes home?" I will. I will tell you another thing that I will do, and if I am in error I will stand corrected. I will send with every patient who goes into these "slaughter houses" a chart, and my written directions what teeth shall be extracted.

DR. SPAULDING: Will those directions be followed?

DR. BOGUE: They will, or that man suffers the consequences at my hands. These men may be just as unworthy as has been stated, but that very unworthiness has given them an amount of practice, and therefore a facility, which we, who do not extract many teeth, and do not allow many teeth to be extracted, do not have. I cannot extract teeth as well as I could fifteen years ago; I have had no practice worth mentioning for fifteen years, and few teeth that have been under my care have been extracted. I have made that statement before and I reiterate it here; but when teeth must be extracted — for regulating purposes, for example — I send my patients to a man that can do it under gas, as a matter of economy of time to myself and advantage to the patient, and

I will guarantee that no man practicing extraction for a living will disobey your instructions many times if he knows that you mean business.

DR. FRIEDRICHS: I think I will illustrate what I wish to say by telling you a fact, not a story. I have a friend in Louisiana who has a brother practicing in Switzerland, and he eventually succeeded in getting his brother to go there, stating that dentists stood in higher appreciation there and were better paid. So this friend of mine went to Neufchatel. One day a patient came who was suffering intensely from toothache. When he saw the case he put him into the chair, and asked him if he wanted to be relieved. He said yes, he came there for that purpose. Of course he went for the forceps, and the patient said, what does that mean? I wish to extract your tooth. No, sir, that tooth is worth five hundred francs. Ah, said the doctor, that is another thing, and he laid the forceps down and went to treating it. If our patients were educated to that point, with that appreciation of their teeth, you could send them to all the Colton institutions with impunity. I believe the proper remedy is to educate the people to the value of their teeth.

BOSTON MEDICAL LIBRARY ASSN. AUG 12 1891

REPORT OF SECTION TWO ON EDUCATION.

By J. N. CROUSE, Chairman.

NOTWITHSTANDING the assertion which has become so familiar to us during the past few years—that the subject of Education has been exhausted, and that the time spent in discussing it is time wasted, your section on Dental Education believe there is no subject of greater importance for this Association to consider.

The growing sentiment on the part of the profession at large in favor of raising the standard of Dental Education has been recognized by the colleges to be imperative, and has resulted in many of the advance steps recently taken by them; and this sentiment is due largely to constant agitation and discussion of the subject. Were discussion to cease, progress would cease; and a profession can poorly afford to rest on laurels already achieved.

The following points this section thinks should be most strongly insisted upon by this association:

1st. That all dental schools shall demand some degree of proficiency in English education as preliminary to entering upon professional study.

2d. That the colleges shall grant no diplomas except to those who attend at least two full courses of lectures.

Except that practitioners of dentistry who present satisfactory evidence of having entered upon practice prior to July 1, 1875, and of having continuously followed the same from that date shall, until July 1, 1885, be entitled to present themselves for examination for the dental degree after attending one course of lectures in a duly recognized dental school.

3d. That this association claims the right to exercise a general supervision over the whole subject of dental education.

In regard to our first proposition, the question very naturally arises, "What attainments shall be required of students entering our dental schools?"

The English Parliament has recently passed an act that dental students shall hereafter pass a good preliminary examination before they begin their professional training.

Under this law, the prescribed examination covers English, Latin, Arithmetic, Algebra, Geometry, Geography, English History, and any one of the following branches at the candidate's option: Greek, French, German, Mechanics, Chemistry, Botany or Zoölogy.

To attempt the establishment of such a standard of preliminary education in this country would perhaps not be practicable at the present time; we are not sufficiently well organized to secure such a law or enforce so desirable an advance. Yet this section is of the opinion that all the colleges should at once take an advance in this direction and require at least a *good English education*, and in addition should require the applicant to have sufficient knowledge of the branches taught and the language employed to comprehend the lectures.

There is no advancement proposed which the profession at large, outside the college faculties, are so unanimously in favor of as that of requiring a good English education as preliminary to entering upon professional study.

Second, your committee deem it very desirable that some unanimity of action be observed on the part of the colleges in regard to requirements for graduation.

On this point there is at present great difference. Some allowing five years' practice as equivalent to one course of lectures, some granting diplomas without requiring the applicant to attend lectures, and others requiring two full courses of lectures of various length.

If the colleges cannot agree upon some uniformity of action, this association should take steps to aid them in uniting on one basis.

While acknowledging the justice of the principle that a man should be entitled to a diploma when his acquirements come up to the proper standard, no matter where he has obtained his education — yet this association cannot sanction the issuing of such

diplomas by parties who are pecuniarily benefited thereby; as college faculties, like "Cæsar's wife," should be above suspicion.

Hence your section feel that colleges should not grant diplomas to those who have not attended lectures, and that the policy of allowing five years' practice to equal one course of lectures should be abandoned.

This brings us to our third proposition, viz: to place the colleges and educational interests, to a certain extent, under the general supervision and control of this association. This proposition is brought before this body at this time for its consideration in the full belief that the power judiciously used would render the association of great assistance to the colleges in effecting needed reforms.

Some action was taken by this association at its last meeting which was calculated to remedy the evil of colleges allowing five years' practice to equal one course of lectures, but it did not have the desired effect. For, although the association did not refuse representation to such colleges as pursued this policy, it expressed in strong terms its disapproval of the practice of dental colleges graduating students upon less than two full courses of lectures, believing it to be detrimental to the interests of dental education, and advised the omission of such inducements from their annual announcements; yet, so far as this section is aware, none of the schools that pursued the five-year policy at that time have abandoned it; and the new schools which have sprung into existence since that action, each offer the five-year practitioners the inducement of a diploma by attending one course of lectures.

Even more, one of the largest schools that had previously abandoned the policy, publicly announced their intention of accepting the action of this association, and would thereafter regard five years' practice as equivalent to one course of lectures, and would receive such as candidates for graduation after attending one course of lectures; as though this association had recommended the practice instead of condemning it.

Therefore, this association needs to take some more positive action in regard to this matter than has heretofore been taken, and in language that cannot be misconstrued. This section, therefore, would offer the following resolutions.

Resolved, That hereafter no dental college shall be entitled to represen-

tation in this Association, that does not require a good English education as a preliminary qualification for its matriculants, to be ascertained by examination.

Resolved, That the colleges shall hereafter grant no diplomas, except to those who attend at least two full courses of lectures. Excepting that practitioners of Dentistry who present satisfactory evidence of having entered upon practice prior to July 1, 1875, and of having continuously followed the same from that date, shall until July 1, 1885, be entitled to present themselves for examination, for the Dental degree, after attending one course of lectures in a duly recognized dental school.

Resolved, That no dental college shall be eligible to representation in this Association, that does not, in its next annual announcement, give notice of its adoption of this limit to the conferring of the degree.

[These resolutions were adopted: see minutes.—*Pub. Com.*]

This section can but express great anxiety at the evident tendency to multiply dental colleges evinced by the birth of three or more since the last meeting of the association.

Even conceding to their founders all that they can claim, neither of them can, in the nature of things, hope to equal the best of those before in successful operation.

It seems to your section that the association should, by a decided voice, discourage this multiplication of schools which, in their opinion, can but tend to lower rather than raise the standard of professional excellence. Concentration of interest in, and effort for, the best of those longer established would surely tend to the greatest advancement.

Regarding the question of whether dentistry is a specialty of medicine, or not, as unimportant, yet believing that a medical education is a desirable preliminary to that of dentistry in the attainment of the highest success in its practice, we would urge the advancement to that acquirement by graduates in dentistry at the earliest practicable day.

DISCUSSIONS.

Dr. SPALDING: As I dissented in the meeting of the section from one of the items in the report, I claim the privilege of giving my views upon that special point, which is the last one stated, namely, that the section regrets the establishment of additional dental colleges. The general expression in the section was that they did not want any more dental colleges, that there were too

many now. I dissent in toto from that idea, and say that we have not half dental colleges enough. The only point to consider in the establishment of dental colleges is their quality. Bring them to every man's door, induce every man who contemplates entering the dental profession, however poor he may be, to enter a college and go through a regular course, and enter the profession by its regular door, and not feel obliged from his financial necessities to climb up in some other way. If we have a number of noble hearted and enthusiastic men who are willing to devote their time and their means to the cause of education, and who choose to organize a dental college at any crossroads, if you please, and gather in the candidates for dentistry who happen to reside within their territory, and educate them properly, shall we say no, you must not do that, if these young men cannot go away to some distant point they shall not have any such facilities to get into the dental profession, they must get in the best way they can? The grand idea is that we must make the holding of a dental degree an uniform thing throughout our entire land. The time is fast coming when no man will be recognized as a dentist who does not hold a degree. How is it to-day? Not one-fourth part of the practicing dentists of the United States hold degrees, and more than that, not more than one quarter of those who came into the profession in the year 1878 held degrees; and now the proposition of this section is to diminish these facilities so that in the future we should have, perhaps, ten per cent. No! if we ever hope to be a profession, if we ever hope to see the day when every man in our ranks shall be an educated man, we have got to extend the facilities for education. I think the proposition is a step backward, and I regret to see a body like this take it. We should be for onward movement. I, of course, voted against this expression in the section, but I believe I stood pretty much alone, and therefore the chairman was justified in saying that the report was nearly unanimous. I am reminded by the chairman that I have been in favor of conferring degrees upon competent men who have not attended two courses. My doctrine has been, that when a man can come up to the proper standard we should not stop to inquire where he obtained his information. The question to consider is, is he competent? and if he is, let us give him the evidence thereof. The section have considered the matter of making some provision for

that class of men who do not hold degrees. No very definite proposition has been entertained, and nothing done, except the provision contained in one of those resolutions, that every man who commenced practice previous to July 1, 1875, and has been in continuous practice since, may, upon attending one course of lectures, obtain a degree. I have no definite scheme to propose. In fact it has not been sufficiently digested, and the only object of these remarks is merely to save that point in the whole question. One important suggestion was made, and that is that the examination of such candidates should not be made by the faculty of the school that grants the degree. In that I most heartily concur. I think the examination should be made by entirely disinterested parties, and I will go further and say that the fees which he pays for his degree should not result to the pecuniary advantage of the institution that grants it. They should have nothing more than enough to pay the expense, and the balance should go to some other fund.

Dr. Bogue: I feel very much like endorsing all the ideas that Dr. Spalding has expressed. I do want that word anxiety or regret put into that report, for the reason that Dr. Spalding has expressed. To begin at the latter end of his remarks, I believe he is the first gentleman connected with any dental college who has here, upon this floor, announced his acceptance of the doctrine that the examining board should not be under the influence of the teaching faculty. I honor him for that expression, and it seems to me that it will not be very long before that view will prevail much more extensively than it does at present. No one who has looked carefully at the working of dental or other colleges can have failed to see that the influence exerted by even two, or three, or four months of intercourse with the student must bias the professors. Dr Spalding asks what we shall do with young men who would enter into the practice of dentistry through some other door than the colleges? I think we should pass state laws and keep them out, if they will not enter through that door. It seems to me that is the tendency of affairs, and as these state laws are passed, one by one, the young men who desire to enter into the practice of dentistry will necessarily go through a process of natural selection — those that should never come in, so far as we can arrange that matter, will not come in, as they will be obliged to go

through the colleges to obtain their object. Hence the multiplicity of dental colleges I look upon as a necessity to be regretted, but still a necessity. I fancy that they will be wanted. The good ones will stand. When Dr. Spalding suggests that we should make an uniform degree which should be imperative throughout the length and breadth of the land, I wish to concur with him. These ideas are presented more vividly to me at this time because I have been noting the far-reaching tendencies and powers of that English law which has been alluded to. There may be two or three gentlemen in this room who know the ins and outs of that law; to me it is marvelous. There is a degree of feeling between the British professional men practicing dentistry and the graduates of American dental colleges, who possess, perhaps, finger craft, but who in other essentials of education may be infinitely below their English brethren, that is hard to understand and impossible to describe. It is not seen upon the surface, but it exists, nevertheless, and becomes manifest in the law recently passed, which recognizes the graduates of only two of our thirteen or more American colleges. One of the causes for the passage of that law, which is a far-reaching, and in my view a most wonderful, enactment, was the practice of English students of going to America for their second course, or their graduation, whence they would return legally "Doctors," while their qualifications as professional men, or for social standing, were greatly below those who had staid at home and gone through a course of training much more profound and searching than any of ours, and yet were not doctors. This was a condition of things that could not long exist; so, as before stated, they have closed the doors against the graduates of all American colleges, save two, although the right is reserved to extend the list of those whose diplomas will be recognized when it shall be proven that the curriculum of any other school shall be equal to the requirements.

Dr. STOCKTON: I have thought the great thing was to have only a few large dental colleges in the land. I was in sympathy with the resolution of the section, but I must confess that since Dr. Spalding has spoken I have somewhat changed my mind. There are a great many young men coming into our profession through our state boards, and these examiners cannot be so well qualified to give a certificate as those who have been long teach-

ing in the schools, and I therefore have, since sitting here, come to this conclusion, that it is best to say to these young men, you must go to the dental colleges and take your diplomas, no matter whether they staid there one year, one month, one week, or one day, if they are qualified to practice Dentistry; and if they are qualified to practice the college should give them the certificate; but the examination should be such, and the degree be such, that when once given, it would never after be questioned. We are making dental colleges all through the land in almost every state, and if you open these dental colleges where men can get their degree, they would rather have it than from any examining board. Make it so that they can get it without expense, but have the standard so high in all that which pertains to Dentistry, and also with reference to their English education, that it will be beneficial to the young men. We know that those who have had a previous education, such as it ought to have been, when entering our profession, take the highest rank among us. I believe this will be the grand solution to this question that is before us to-day.

Dr. SHEPARD: I move that the motion that this report be adopted be laid upon the table.

The motion was agreed to.

Dr. SHEPARD: I now move the adoption of the resolutions, which brings the whole matter before us for discussion.

Dr. SMITH: I would like to read some statistics. It is affirmed that there are in the United States 12,000 practicing dentists, those who have a local habitation and a name. I think it is a proper estimate that there are legitimate students of dentistry, with those 12,000,—at least 1,800 to 2,000, who contemplate pursuing dentistry as an occupation. Last year the matriculants of all our colleges numbered 672, of whom fifty were foreigners, leaving about 622 matriculants in our colleges from the United States. It is curious to know where those students come from. I cannot give you the statistics as to where the matriculants come from, but I can only give you the statistics as to where the graduates reside. Before proceeding to that point I will state the number of graduates. There are sixteen states who graduated 158, all the other states 51, giving 209 graduates altogether in all the colleges from the United States. This is nearly accurate. There were thirty-three foreign graduates, making 242 graduates in all. I have esti-

mated that there are from 1,800 to 2,000 legitimate students, which would give about fifteen to every 100 in practice. Now you see if all the dental students went to college each college would have about 200; but, as it is, as we only have about one-third in the colleges, some of the present number of colleges are impoverished for want of students. You will not find as many students in large cities with practitioners as you find in the country. I know of some country practitioners who have three or four. There is Illinois with her 400 dentists; last year she had three students that graduated, possibly four. There were about nine students in the colleges from this state, because the graduating list indicates the number in the colleges. Some of the colleges graduated four, others two and three. Harvard, the more advanced college, had thirteen students, and graduated but two or three. These are some of the facts which have a bearing upon the subject, and it is well to consider them when you theorize about dental education. Especially should members of this section ponder the status of dental education in their own states while proposing changes called reforms in the methods of the colleges.

Dr. CROUSE: How do you get at the number of students, if you call them students, that there are in the United States; how do you make it 2,000? And I would ask another question, How long would it take to multiply the number of practitioners from 12,000 to 50,000 at that rate of students each year?

Dr. SMITH: It is an approximation. It is my judgment and that of others. Probably there are large numbers retiring. And there are many who are not fit for the business of dentistry, and very soon engage in other occupations.

Dr. CROUSE: They never go out.

Dr. SMITH: They go out very frequently from a variety of causes. Not a few are unable to make a living.

Dr. SHEPARD: As a matter of fact, the statement with regard to Harvard is not correct. There were five graduates last year, 1878–9, out of thirteen in the class,—in 1877–8 there were six graduates with a class of seventeen.

Dr. SMITH: I don't claim accuracy of course. It is an approximation.

Dr. CROUSE: The question is now, what are you going to do about it?

Dr. SMITH: That is for you to say. Some say, advance the standard of dental education. I have my reply, but I am not giving that. It is peculiar that the large bulk of students came from very few states. Last year Pennsylvania had 39 graduates, Ohio 24, New York 18, Massachusetts 17, and Maryland 15, making in all 113. Those five states, it will be observed, had more than half, and the balance of the states had only 96. Of those states, Pennsylvania, Ohio and New York have state laws regulating the practice of dentistry. We find, also, that in those states are located the older dental colleges.

Dr. COOK: In regard to New York, I will say that the law now in force does not affect, in any way, the number of graduates. There is nothing in the law that requires any man to take a degree. There is a law, passed at the last session of the legislature, but not in force yet, that may possibly affect the number of students at our Dental schools.

Dr. SMITH: Where there are facilities for obtaining dental education we find the largest number of graduates. Those states which have had dental colleges the longest time furnish the bulk of graduates.

Dr. BOGUE: I am reminded that I conveyed a false impression. I stated that the college of surgeons in England were able, in view of this law which has lately been passed, to extend their time and enlarge their curriculum. In so doing I put the thing exactly backend foremost. They did extend their time, and they did call for an examination in arts, and then they found their classes dwindling. The law was the remedy for that.

Dr. COOK: I would say *a* remedy. The discussion in reference to a law in the United Kingdom, regulating the practice of dentistry, commenced some three years before it was passed by Parliament. Large meetings were held at various points in the kingdom and all questions bearing upon it fully considered, all of which is a matter of record. There is no reason to believe that the presence of a few American dentists in England, or the desire to keep their students from going abroad to procure a diploma on qualifications inferior to those required at their own schools, was the exciting cause of the demand or request for a law. The same reason might as well be assigned for the passing of "dental laws" in our own states. If I rightly understand the last speaker, his

remarks do injustice to our friends over the sea, and I think I pretty well understand what has been said and done, as far as their journals make record. I do not see the injustice of *not* permitting the registration of foreigners on qualifications inferior to those demanded of their own people. It would seem to be only justice to their own licentiates that such discrimination be made.

Dr. CROUSE: I did not intend to speak upon this subject, but, as the discussion has taken a conversational turn, and seems not to be leading up to the points under consideration, which are the resolutions before us, I wish to say a few words. The first of these resolutions requires a preliminary education for those entering the schools. This, in my opinion, is a step that all colleges can judiciously take, and I think this Association can, by its voice, assist them to that advance, and, as near as I can find out, it is the desire of all the colleges that this advance step should be taken. We were enthusiastic in our section on the passage of this resolution, and I think it needs no discussion. The gist of it can be seen at a glance,—that we should have an examination in reference to English education, and would-be pupils should have a sufficient knowledge of the subjects to be taught, to enable them to comprehend what the lecturer is talking about. If the pupil enters college without any knowledge of anatomy or chemistry, he will not be able easily to comprehend the lectures upon those subjects, and his time will be, to a great extent, wasted. The second resolution is the one we had up last year, with an amendment. The resolution which I should like to see this Association adopt would be, that no college should be allowed representation in this Association that did not require two full courses of lectures; but as a compromise measure, and in order to have our report go in as the report of the section, we attached this amendment which allows colleges to grant diplomas to such as are qualified who entered the practice of dentistry before 1875 and up to 1885, giving about five years' continuance to that plan, with the understanding that after 1885 the five years' policy shall be done away with. In talking with the representatives of different schools, I am delighted to find that the tendency on the part of a great many is to make the course for graduation three years, instead of two,—an advance of vital importance; for what can the average student acquire of anatomy or chemistry alone in one or two courses of lectures.

He will not become an anatomist or a chemist in that length of time. This want of thoroughness in our schools heretofore will, in a measure, explain why we have had no report on chemistry this year. My friend Spalding has expressed a great deal of sympathy for the poor man. The fact of the business is there are many born to be poor men. They will be poor in the profession or out of it, and we can't help them. You present to the right kind of a poor man a plan for his education and he will work to it, if it takes two years or three years, and if he has not the material in him to enable him to do this, he is not fit for a dentist anyway. I had a young man in my office for a month, some time ago, and I said to him "you go back to your father's farm and stay; you will make a good farmer, but you will never make a dentist." If a man cannot get down to study, if he has no memory, if he has no application, and no mechanical ingenuity, he cannot make a dentist. It is no kindness to young men to make the educational standard low. After they get into practice and see that it would have been for their best interest to take a more full course, they will blame you for this easy method which you now so generously offer, and will say: "I wish you had compelled me to take a more full course and to prepare myself more thoroughly before I started to practice." Let us increase the facilities for real learning, and encourage those institutions that now possess them to the greatest extent. Many of these dental colleges are started from purely selfish motives; for instance, a dealer in dental materials starts one, believing it will be of advantage to his trade; a medical institution that has not a very large list of students attaches a dental department, hoping to increase its revenue, and enabling it to swell the numbers in its circular. I am sure that this multiplying of colleges mainly tends to cripple good institutions. A fellow who has any snap can pay the expense of attending two courses of lectures. If he has not vim enough in him to do that he is not fit for the profession.

Dr. WERNER: I think dental education, like general education, a most important branch of sociology. Sociology and biology have close relations and move in the same course of development. This is a free democratic republic; we consider here that no laws are necessary to protect medicine or dentistry. In European countries it is considered necessary to protect the medical as well as the dental profession, consequently they have fewer colleges and

higher standards. As long as we have no law to protect our profession in America it is useless to talk of a few colleges and higher standards. That is the experience of older nations, and America will learn it very soon. England has decided by its law, lately enacted, to protect dentistry. America has not as yet spoken in that way. I am advocating laws to protect medicine and dentistry, unless we can rely upon the intelligence of the masses as sufficient protection. The masses do not think it in their own interests, or they would ask for protective laws. They do not ask to be protected from a lack of intelligence upon the subject. When they do ask it they will have just what they ask for.

Dr. ATKINSON: Who has been to the foundation? Who knows whether he has built upon the rock or the sand? What does the degree mean? We have sixty-five medical colleges chartered, and graduating pupils every year in the United States. Are there five of them that ought, by common honesty or legitimacy, to be permitted to graduate a single M.D.? We have thirteen dental colleges who graduate men for the practice of dentistry. We are trying to get at some means whereby to select from the mass of pupils that present themselves as matriculants to the various schools of dentistry, so that we can discriminate, and secure thereby efficient, honest, upright men, that shall be a blessing to the community, a comfort to themselves and an honor to their calling. How shall we do this? is the question before us. That is the underthought of every individual who has spoken, and I agree with all the speakers in a certain sense, and disagree with them all in a certain sense, and that is the sense we need not quarrel about; it is a sense of the disabilities that we have inherited from the abominable methods of our general education in the public schools, in the seminaries, in the colleges and in the universities, because they have built upon sand. When the weight of the building became great enough it toppled over. If I were required to make number-one dentists of 500 young men of good natural qualifications, I would prefer to have them without A.B., A.M. or M.D. attached to their names. And why? Because they have had such miserable methods by which to make these examinations, that they, every one, are false. There is not an M.D. in the United States of America this day that is not a lie upon the face of it. It tells what is not true, as to the qualifications of the man holding it.

It says he is entitled, by legitimacy, to all the rights and immunities belonging to this degree. Will you be surprised if I say what I have repeatedly said before, that I am sorry that there are any degrees at all? I see I am not making the other point. I said I would rather not have them with these false and mischievous methods of education upon them, but take them green and fresh, and in five years make them better scientists and operators than they can possibly be made by these men who have dubbed them A.B.'s, A.M.'s and M.D.'s as qualifying conditions. They have led to what the simple degree says, not what it means, because they do not know what it means. They do not have the knowledge of what it ought to mean. I do not say we shall be any more honest than our ancestors, and our predecessors, and teachers; but we shall be more illuminated, we shall have better light by which to direct our steps in the performance of the works conceived in our affections and intellects, and we shall be able to make less crooked ways to our feet, and we shall be able to be justified in our own consciences and the opinion of our pupils, if we will forget the old methods and begin to study anew, teaching our pupils conversationally and demonstrably. It has been said we have never had any report on chemistry. As differential chemistry, I hope we never may have a report on it. If we were to follow the leadings of these men who call themselves chemists, and offer the doctrine for acceptance, I hope we will never have. There is a chemical aspect to everything we do. We must learn a little about the old, dignified objective and subjective; and we must so understand these first postulates, as to enable us to be teachers that shall so commend ourselves to our pupils as to be sought for in places of trust and responsibility. I know what I say, I have seen what I speak of, and I testify the conviction of my own mind that we have no college to-day whose chairs are filled by men preëminently fitted to occupy the various seats in the various faculties of the various institutions.

Dr. BARRETT: If I understand Dr. Atkinson aright, he would abolish all education whatever in dental institutions; for, if he says he would have them without any education, he necessarily goes back to that point.

Dr. ATKINSON: By preference to taking such as they are. Don't misrepresent me.

Dr. BARRETT: I did not use the words as he spoke them, though I might honestly have done so. He can put his own construction upon them. What is the point at issue? We are talking about the education that we have; how we can make it better; how we can arrive at a higher standard; whether by increasing the number of colleges, by establishing preliminary examinations requisite for entrance to colleges, or whether there should be no examination at all. The first resolution provides that there shall be such preliminary evidence of scholastic training. We are supposed to be considering the materials that are offered, and, if I understand the drift of Dr. Atkinson's remarks, it is that no qualification should be demanded of a student for entering a dental college. I think we will all take issue with him on that ground, because for the proper understanding of the truths of the principles that are taught in dental colleges, it requires some prerequisite English education. As a preliminary step, it is absolutely essential that a man have some knowledge of the construction of the language which is to become technical. But what shall be done? Is the door to be closed? Are we to relegate professional training to a few dental colleges? Is that in accordance with the demands of the dental profession, or of any profession, that it shall be only for the favored few? By no means. I think we should in professional, as in general education, open the door of opportunity to every one who comes knocking at the portal, and place the means of obtaining knowledge within the reach of every man. We may not all agree touching the general theory of the doctrine of evolution, but it will be beautifully adapted to the necessities of the dental profession as regards colleges, and will result in the survival of the fittest. Place a dental college at every four corners, if you will, simply premising that the teaching shall be sufficient, and the law of supply and demand will settle which shall live and which shall die.

Dr. STELLWAGEN: It is only by elevating ourselves that we can elevate our profession. If we individually are so exalted by education that every one who comes in contact with us will recognize that to be a dentist is an honorable calling, I do not think that we will be at any trouble about having laws to protect and laws to govern. As to how this shall be accomplished, of course there is a vast difference of opinion. At the very outset there is a question

as to what sort of material we shall make dentists of; in other words, what sort of men we shall admit into dental colleges. If I may be allowed to take exceptions upon the floor, as in the committee, I object to the narrow-minded view that a man must have an *English* education. The gentleman who preceded me spoke of sociology, and spoke very pertinently and to the point. Sociology brings about the study of a great variety of ologies, and among them is one which we call philology, and the man who is a philologist can quickly grasp a new language. Hence, for us to claim that a man must be educated in the English language is an assumption that will contract the scope of the profession. You are to require them to have an *English* education. What has it to do with dentistry to know whether the Plantaganet or the Guelph family happened to be the governing family of England? Teaching at dental colleges does not depend alone upon the use of language. There is a common language of science which enables two men, not speaking a common tongue, to have scientific intercourse with each other. A learned German, or a learned Frenchman, or a learned Englishman, all use technical terms nearly similar. In addition, education is imparted by means of illustrations and demonstrations. It is astonishing how readily a man not only acquires the art and science of dentistry, but at the same time the English language, by listening to the descriptions and seeing the manipulations before him. Hence, Mr. President, I should move that the first resolution be laid upon the table. It is exceedingly difficult for us at present, certainly it is too early for us, to establish any such line of demarkation.

With regard to those who are already in practice. How long does it take to examine a man and decide whether he is a practitioner or fit to become a practitioner of dentistry? I hold that it cannot be done in a few days or a few weeks, as some gentlemen here seem to think. Will any one be perfectly satisfied to endorse another by signing his diploma if he has been in view for a few days only, and had, perhaps, fifteen minutes' conversation with him in the way of an examination? If this be just, it opens the door to one of the most dangerous means for undermining the standard of our profession. It requires months of examination, as they stand in a class, as they answer the questions that are put by the examiners or the professors, to enable us to judge whether men

are fit to practice dentistry or not. It would be most desirable if we could have a board composed of the very finest talent for making this examination, that could spend enough time every year and perform the duty thoroughly. But any examining board that merely brings candidates before it for a few days, would be very apt to allow incompetent ones to enter the profession. With regard to the multiplication of colleges, we cannot *regret* the tendency to an increase in the number, until we see that they have done harm, but we can have an anxiety as to the results of such additions, because there are not sufficient students to support so many. I do not mean dirty dollars, but rather the stimulus of seeing a class around who look up to the lecturer, and drink in what he says, and awaken him to his best efforts. That is what I understand this association should express — an anxiety lest, by an overplus of colleges, the standard of education may be lowered so as to coax and persuade ineligible men to enter the colleges, in order to get sufficient classes. Does any school shut out worthy men for the want of money? We have had it said that the spreading of colleges broadcast over the land was necessary, in order that we should accommodate students who could not afford to come a long distance and spend much money. Those who pay for their tickets, and work for the money to pay for them, are generally those who become most creditable members of the profession. But there are others, such as our friend from Chicago has spoken of, who come begging their way through college and into the profession, and then beg their way through life. I have seen but few of these men who ever amounted to anything. It is the man that has the energy within him, and who says, if he has not the money, "I will sign a note and promise to pay it, I do not want an education for nothing," who makes his mark. Such can always be accommodated. I do not think any school in the country wants money alone. When I perform a dental operation I do not take the money as an equivalent for services rendered, but as an acknowledgment of that which money cannot pay for. Others may take the money if they please, and feel in taking it that they have taken their full fee. The tooth-carpenter and the professional dentist are not in the same category.

Dr. SHEPARD: A large part of the gentleman's speech has been taken up with an oration on philology, being nothing but a

quibble upon the phraseology of the first resolution. I should suppose that any person of intelligence and cultivation, who had mingled much among men, would understand that the phrase "a good English education" was but another term for what is otherwise expressed as a common-school education. The idea of objecting on that ground is but a quibble and not an argument against the resolution, and I was very sorry to hear him announce that he was going to move to lay the resolution upon the table. The proper thing to do, it seems to me, is to suggest an amendment rather than to put it where it cannot be discussed any more. I will not say that it cannot be improved, but ordinary minds would understand it as a good common-school education, such as is possessed by any graduate of a high school, or by any graduate of a German gymnasium, whether he understands the English language or not. A large part of the discussion upon these resolutions seems to me to have been taken up by fault-finding and grumbling against the present condition of things. There are always plenty of grumblers who are not satisfied with things as they are. We are all of us in that chronic condition. The section which reported this resolution is in that condition, and is trying to suggest a remedy. There has been almost nothing said, directly, upon the question of the adoption or rejection of the resolutions. I am in favor of the adoption of these resolutions. They do not come up to my views. They are very far behind what I would like to see adopted. I grumbled a great deal at these resolutions in the section, but they have been reported by the section as a compromise. Members of the section made their little speeches in the section in regard to the resolutions, and as the result of those speeches the compromise was adopted, and they united in the compromise, but now they come here and make similar speeches in opposition. Are the resolutions an advance? That is the first question. The second question is, are they as far in advance as the Association is prepared to adopt? Those are the only two questions. If they are in advance they should be adopted. If they are not as far in advance as the Association is ready to vote, then amend them and put them a peg higher. It can be done in several ways. One way is to amend the second resolution by putting the date back to the first of July, 1870, instead of the first of July, 1875, cutting out the men who have entered the profession during the years

between 1870 and 1875 from participation in the one-term course. If I may speak of the action of the section, the original motion in the section was to make it 1870, but the compromise of 1875 was carried, which opened the door still wider. I wish the Association were ready to vote 1870 instead of 1875, for it is a step higher. If 1875 is too high for the Association to vote, it can be made '76, or '77, or '78, and so admit a still larger number of this great mass throughout the land who have no degree. I am on record since 1872, in this Association, as will be found in the transactions, in opposition to the granting of degrees by the colleges upon one course of lectures, but I have been willing that certain colleges should do that if they pleased, so as to keep the doors open wide for those worthy practitioners who had failed to avail themselves of the privilege, but I think a great mistake will be made by the Association at this day, when these doors have been open for thirty years, if it does not take the stand that our colleges are not merely institutions for the graduating of men, giving them their diplomas simply to entitle them to a legal doctorate, but are for the great purpose of educating young men and bringing them forward in a legitimate, correct and proper manner to enter the profession through their doors. That time, I think, has come, and the Association should take the stand now that they should look to the young men—the newcomers into the profession—and leave those where they are who have neglected the advantages previously offered. The first resolution covers the subject of a proper preliminary education. The second resolution covers the point of one course of lectures, and I hope to see it adopted. The third resolution does all that this Association can do as a body corporate, which is to exclude from membership those colleges which do not adopt the course prescribed. I would go still further than that, individually, and claim for this Association power to legislate more strongly and bindingly on the colleges; but we cannot go as far as some of us would wish. I hope, therefore, to see these resolutions adopted, substantially, as they are, or amended to make them stronger.

Dr. HUNT: We are all engaged in one common object, and that is, the advancement and improvement of our profession. We only differ as to the means necessary to attain that object. It was remarked in the report, very happily and properly, that the subject

of dental education was not by any means exhausted. We are in a progressive state, and it is our duty to do the best we can under the circumstances. It has been said that the shorter term of pupilage has been offered by some colleges as an inducement to those who wished to enter the profession of dentistry, to come to those institutions and get their diplomas in a short and easy way. The college with which I am connected offered what they call that inducement. It took the ground that the standard for granting a diploma should be merit alone, qualification and proficiency in all the branches which are necessary in the practice of dentistry, and not the length of time which was consumed in study. At the same time the college placed the standard as high as they dared to, which was as high as that of any other college in the country; and that is the correct principle—one which has been adopted by the Johns Hopkins University of Maryland, which has at its command all the money that is necessary to carry out any system. It was adopted after careful deliberation upon the best information that could be obtained concerning educational systems. We had an examining board for the college I refer to. I am very glad that Dr. Stellwagen put forward his argument intended to demolish the position taken, of the advisability of an examination by others than the faculty, because his argument is demolished by the statement I am about to make. The board of regents, which is the examining board I refer to, examine only those who have passed the faculty, and received their approval; and if the board does anything, it is to turn back, as it has the power, those who have been examined by the faculty, if the latter has made a mistake. With regard to the preliminary examination referred to in the first resolution, I heartily agree with the position assumed of the absolute necessity of a preliminary examination by the faculty of a college, who shall have the privilege of saying what material shall come into their hands for dental instruction. If a man cannot write a good grammatical letter, if he does not understand the English language sufficiently for that, he certainly is not qualified to learn a profession, whether dentistry, medicine, law or theology. This cutting down of the course to one term is intended to meet those cases that the section thought required to be made an exception of. The time will come when all those who are now practicing dentistry will have either gone to their long home, or have entered the pro-

fession through the door of a college. When that time comes, we cannot say that the matriculant can graduate in one year, but at this time the necessity exists, which the section recognized, of making exceptions to that rule. With reference to the multiplication of colleges, I will only say that the section takes the ground that a college should be established where a college is proper and necessary, and not otherwise. We in Maryland and the District of Columbia have concluded that two colleges are too many for that locality, and so have consolidated them, and in the consolidation our faculties have been united.

One more point I wish to touch, and that is, that the whole tone of the report takes one position which the resolution does not. The tone of the report claims the right to prescribe what colleges shall do. I agree that there should be a single association in this country which should have the legitimate, conceded and delegated right to control colleges as to their general standing, and as to their standard of education. We have not, at this time, that right. I cannot vote for the second and third resolutions; though conceding the right of this Association to make the claims set up in them, I do not think it has the delegated authority to support or justify those claims. The first I shall vote for.

Dr. PEIRCE: I wish to refer to the difficulties in the way of adopting any common standard of qualifications. Some time since I attended a meeting of the representatives of forty of the medical schools of the country, called for the special purpose of adopting such a standard. After two days spent in discussing the subject and perfecting resolutions embodying the ideas of the representatives, the vote on their final adoption was taken, and the resolutions were lost, the representative of one of the leading colleges stating that their work could not be binding on the schools, but would be merely advisory.

I shall second every effort of this Association to urge upon every school to take that step, and advise a preliminary examination, establishing some standard which every student must attain before he can come into the college; but we shall probably have the same difficulty in establishing this course that the medical fraternity have had.

Dr. SPALDING: I was aware of the results of these deliberations, but I hold that we are not to be guided in our course by any

examples that may be set by the medical profession. We are an independent profession, in my opinion, and we must mark out our own course, and decide what we shall do for ourselves. In the estimation of medical men undoubtedly they thought the prosperity of their colleges would be affected by such restrictive action. Perhaps that may be the same case with us. Suppose it is. What of that? The question we are to consider is, whether it will aid the profession. I think no one can question that the future of our profession will be advanced by enforcing this requirement. Therefore I am in favor of it, having acted upon that plan ever since the college I am now connected with has been established. I am satisfied with its operation, having rejected a number of applicants for the reason they had not the proper preliminary qualifications. We know exactly how it works, and we know it works well in the main. You may lose now and then an applicant, but you will soon establish for yourselves a reputation. I am earnestly in favor of that provision and hope it will be unanimously adopted.

Dr. REHWINKLE: It seems to me that with the present light we have on the subject of education, we ought not to have any great difficulty in coming to an intelligent conclusion in regard to these resolutions. We now have arrived at the time when we must do either one of two things, we must adopt these resolutions in such a way as will give an earnest evidence to the students, as well as to the public, that the colleges mean precisely what they claim in their announcements; or else we must acknowledge that the whole thing is mere buncombe. Now if there is any dental association called upon to sustain the colleges, I won't say prescribe for the colleges, but to sustain them in their earnest efforts to do their best, it is, I think, this association. In regard to preliminary examination, I differ from my friend Stellwagen in his blind criticism upon the phraseology of the first resolution. I understood at once that it meant a common-school education, such as the laws of this country provide for all citizens.

Our desire is to secure a better professional education for practicing dentists, and, also, to convince the public that our dental colleges send out educated men. If we ignore the preliminary common-school education, illiterate men, though they may often acquire great skill as manipulators, may yet, for the want of this education, which all professional men are presumed to possess,

often bring disgrace upon the profession as well as upon the dental college which graduated them. I cannot see that there should be any objection to this resolution. It seems to me every one should agree with it, and that it should be made as binding as possible.

In regard to granting diplomas regardless of study, there is something to be said on both sides. In the abstract that principle might be correct, but we must bear in mind that a college faculty is not a board of examiners, placed in power by the state, or by any other authority, simply to pass judgment upon certain qualifications of the candidate. When a college issues a diploma it conveys a certain degree of honor and distinction with it. The diploma carries with it the whole moral force of the institution that issues it, and, therefore, I think a dental college ought to insist upon students passing sufficient time within its own walls to acquire the proper knowledge through its own professors and by its own peculiar manner of teaching, before granting diplomas to them. If the principle referred to is to be adopted at all, it seems to me that as far as it would be proper to carry it would be for colleges to simply grant a certificate of qualification, without conferring any title.

As the colleges only are entitled and privileged to confer degrees, we certainly ought to require of them that they shall insist upon an education within themselves. I agree with Dr. Stellwagen, that a thorough knowledge of a student's acquirements can not be learned from an examination, unless it is extended over a considerable length of time. College faculties, as well as examining boards, very soon fall into a routine way of examination, and many succeed in passing when really the faculty or the board which examines them are not properly enlightened as to their real qualifications. Allusion has been made by Dr. Bogue to the low estimation in which our colleges are held in Europe. During the summer, I learned from a gentleman from London, a graduate of a reputable dental college in Philadelphia, and a man of note, that upon presenting his diploma to the Registrar he was told that they did not recognize it, nor any diplomas from this country except those issued from universities. Another reason for the disrepute of our colleges abroad may be found in the fact that there is a person whose name is John Buchanan, claiming the title of M.D., whose advertisement I find in the British Review, which I hold in my hand, of the "American University Dental College," Philadelphia. When we bear in mind that this bogus institution is

perhaps better known in England than it is in America as a miserable fraud from beginning to end, and when we bear in mind that this advertisement has been published month after month in such a respectable journal as the Monthly Review, and that many of these fraudulent diplomas have been sold throughout Europe, it ought not to seem strange that they do not think much of the title D.D.S. I have the evidence in my hands showing that diplomas have been granted to parties who have never been inside of the doors of this institution, and who could give no evidence of adequate knowledge and acquirements in dentistry, if, indeed, they had any. This proceeding has been going on from year to year, to the disgust of qualified English dentists, and hence it ought not to appear strange to us that the title of D.D.S. is not highly esteemed by the profession in England or Germany, where a great many of these diplomas are bought. There has been considerable discussion in Germany in regard to the character and merits of our dental institutions, one party contending that the fraudulent institution which is advertised in foreign countries only, and which hardly one in a thousand ever heard of in this, is equally as respectable as the other dental colleges in Philadelphia, colleges of high respectability and which are recognized as such by the profession in this country.

A certain Mr. Chapison, of Berlin, has published a little pamphlet, entitled, "Anti-Petermann," wherein he strongly upholds and endeavors to prove the respectability of the above-named bogus institution, and others of like character; whereas, on the other hand, he cannot say enough to belittle and defame the Pennsylvania and Philadelphia Dental Colleges. He represents the fraudulent institutions of John Buchanan as great "State Universities," and the highly respectable dental colleges as mere private and obscure "tooth-breaker shops." These statements, although preposterous and absurd, are, nevertheless, believed by some and upheld by others, who are the victims of Buchanan's frauds, and possessors of diplomas of universities of fraud.

As the title of this pamphlet indicates, it is a personal attack upon Dr. Adolf Petermann, of Frankfort-on-the-Main, who has, through his dental almanac, exposed the doings of John Buchanan, and put a check to the traffic in bogus doctor diplomas of so-called American universities. He has upheld and ever stands ready to defend the character and integrity of our dental colleges.

REPORT OF SECTION THREE

ON

DENTAL LITERATURE.

By J. TAFT.

THE literature of the world is one of its most potent instrumentalities. No important department or branch of human occupation can afford to ignore this agency. The arts and sciences, the professions, the trades, agriculture, and even occupations of the more menial sort, have each their appropriate literature, upon which they largely depend for development, growth and strength.

Literature is made to serve a great variety of purposes and causes; too often the objectionable and pernicious, as well as the commendable and the good. Literature is a written record of the things, the acts, experiences, opinions, suggestions and thoughts of those who have been, and now are, upon the stage. Dentistry had not a name or a place among the professions, nor in the world, till a literature began to develop for it a record of its accomplishments and capabilities, its modes and aims. In the records of the past much is found of interest, instruction and encouragement; in these is seen the way of progress and the manner in which present attainments have been made.

It is impossible to estimate with any precision the influence of the literature of our profession from the beginning to the present. That it has been great no one will venture to question; indeed the present status of dentistry is in a great measure due to it. In verification of this, a hasty glance at the past may not be amiss.

During the 17th century but little was written upon the subject of dentistry, only a few crude efforts were made, indeed nothing that looked toward or indicated the establishment of a professional or even a special occupation.

During the 18th century the importance and value of the teeth began to be more fully realized; why this was so, I will not now stop to inquire, but will leave it with the remark that this century was characterized by a spirit of inquiry, investigation and discovery, that hitherto had been unknown.

Concurrent with this growing interest and inquiry, was the production and issue of a considerable number of works upon the teeth and kindred subjects. Most of these were of English and French origin. Of twenty works written prior to the year 1800, eight were produced in Great Britain, nearly all in London; and eleven in France, chiefly in Paris; and one in Vienna.

Those in England embraced such names as Jos. Hurlock, in 1742; Robt. Wooffendale, in 1783; John Hunter, Thos. Berdmore, in 1770; Mayer Lewis, in 1772. Those of France, M. Jourdain, P. Fouchard, M. Barron, M. Gerauldy, in 1737.

This by no means exhausts the list of writers upon the teeth during the 18th century, but it is quite sufficient to show that there was a growing interest upon the subject. During the 17th century there was very little written upon the teeth, and doubtless the interest in, and knowledge of, the subject was at a correspondingly low ebb.

Prior to the present century nothing of any note was written in this country upon the teeth, or anything pertaining to them. During the first forty years of this period works multiplied rapidly; nearly all of these were written and published in London and Paris.

The first treatise upon dentistry in the United States was by Dr. Samuel Sheldon Fitch. His observations upon the importance of the teeth was published in 1828, and his system of Dental Surgery in 1829. Other productions soon followed. The writings of Drs. Eleazer Parmley, Solyman Brown, Horace H. Hayden, Harvy Burdell, S. P. Hullihen and Chapin A. Harris, are familiar to all students in our profession.

The influence and results of the growing literature of our profession during this period are worthy of consideration. The first mention of the existence of associated effort is made in the first volume of the American Journal of Dental Science (p. 17), in 1839, in which is mentioned the Dental Association of Western New York, and the Society of Surgeon Dentists of the City of New York.

During the year 1840 the American Society of Dental Surgeons was organized, and was an agent of great good for about fifteen years. Subsequently other societies were formed. The number continued to increase, until now there are in active operation in this country about one hundred dental associations. The good accomplished for the profession and for mankind by this kind of effort is beyond estimation.

That this work has been supported, strengthened and made efficient by the literature of the profession, is plain to the casual observer. Can any one imagine extensive and efficient coöperative effort, without such a medium of communication as the written word affords?

In 1839 the first periodical devoted to dental art and science was established, and has continued its issue to the present time. "The American Journal of Dental Science," the pioneer, has exercised an immense influence in molding the profession since the beginning of our periodical literature. Many others have found place and favor, viz: "The New York Dental Recorder," 1846; "The Dental Register of the West," 1847; "The Dental News Letter," 1847; "The Dental Cosmos," substituted for the "News Letter" in 1859; "The Dental Times," in 1863; "The Missouri Dental Journal," in 1869; "The Dental Miscellany," in 1874. Quite a number of others of less note and pretension have appeared from time to time; some of them are still living, and each accomplishing good.

As the formation of a dental association was in the mind and heart of Dr. H. H. Hayden, for several years before fruition, so in the mind of Dr. Chapin A. Harris, the idea of a dental college was, for a few years at least, maturing. The thought passed from him to others, and in 1839 the Baltimore College of Dental Surgery, the first in the world, was organized, and in 1840 its first session was held. Five years afterward the Ohio College of Dental Surgery was organized and entered upon a career which has been creditable to its founders.

In the succeeding years other colleges were founded, and at the present time there are in this country fourteen in active operation, each doing good work for the profession and mankind.

The very existence of the three grand agencies just enumerated is based upon and sustained by our literature. Without it, how

feeble an agency would our associations be? What would have been the success of our colleges without a textual literature? That the written productions of our profession have been free from error and palpable defects, none will venture to claim; indeed, it may be said that they all bear the stamp of imperfection. But let not a severe judgment be passed till due consideration is exercised.

In the earlier periods of our profession, very circumscribed and imperfect views were entertained upon almost all the subjects connected with either its principles or practice, and between these and that which was written upon them, there would, of necessity, be a correspondence.

But rapid development, change and growth have in a marked degree characterized the dental profession throughout its history, and this involved constant variation in what was said and written about it. So great and rapid have been the vicissitudes, that the descriptions, declarations and instructions that have been announced — and correctly too — at one period have within a few months, or years at most, become obsolete; but we are not therefore to infer from this that they are of no value.

The strength we derive from the bread we eat to-day will be expended by to-morrow, and is then gone forever. Was it therefore of no value? Our literature of the past should be valued for that which it has accomplished.

Again, in the earlier periods of the profession far less importance was attached to the writings of our specialty than there is to-day, and so much less was attempted. A retrospective view of the literature of our profession, of the influence exercised by it, must carry with it the conviction that it has been one of the chief agencies of its development, growth and support.

If these things are true, we should value the literature of our profession. That it should be improved all will admit; far more care should be exercised in this direction in the future than has been in the past, and especially is this true of the periodical matter. This may with truth be said, however, that our periodicals compare favorably with the publications issued by the medical profession.

The past year has added something to our textual writings. The following are worthy of notice:

The Antiseptic Treatment of Diseases of Tooth Pulp, with a

presentation of the principles of secondary formation in the pulp. By ADOLPH WITZEL. With eighteen litho- and chromo-lithographic plates, and seventy wood-cut illustrations.

The following subjects are presented and fully discussed, viz:

1. On the action of arsenical paste.
2. Capping exposed pulps.
3. Amputation of partially inflamed pulp crowns.
4. New formations in the pulp.
5. Causes and consequences of dentine new-formations in the pulp.
6. Total inflammation of the pulp.
7. Filling root canals.
8. Treatment of failures.
9. Final remarks and observations.

The author discusses these subjects freely. He starts out by giving the treatment of inflamed pulps. The first section gives the treatment by the use of arsenic: he advocates its use. After adverting to the theories that have been advanced in regard to its action, he gives his own practice, and the reasons for it. Some of these views are somewhat at variance with our observation; for instance, he says that arsenic applied to a healthy pulp, which has not been wounded, acts only superficially, and applied on a partially inflamed pulp devitalizes only the diseased or inflamed part, whilst the healthy parts of the pulp in the crown and roots will not be destroyed.

In all cases, just previous to the application of the arsenious paste, he applies a mixture of dilute carbolic acid and tannin for a few moments, and immediately upon the removal of this applies the arsenic. The effect of the tannin and carbolic acid is to anesthetize the pulp, and lessen the pain occasioned by the application of the arsenic. It also lessens the pain of amputation.

He mentions that there is no change in the tissues that do not come in direct contact with the arsenic. Any change outside of this contact is due to the preëxisting pulp inflammation.

He presents very beautiful illustrations of pulps magnified ten diameters to prove his position.

In cases where the results are not such as he has given, it is because of failure in the proper application of the agent, or the treatment has been defective at some point.

He suggests the addition of a small portion of morphine to the arsenic paste.

For capping he gives nothing new. He mentions that in every instance in which a wounded pulp is covered with oxychloride of zinc in contact, it mummifies.

When a layer of softened dentine covers the pulp he applies the tannin solution, then removes it in all cases, exposing the pulp, then treats as before indicated.

The diagnosis for an irritated pulp is made by a jet of cold water upon the dentine nearest the pulp, which will pain but a moment when the pulp is but slightly irritated, but it will give pain for a longer period when the organ is partially inflamed.

He advocates the removal of a diseased portion of pulp, and the preservation of the remainder. He gives cases, wood-cuts and plates, illustrating his views and practice. He says: "Previous to the year 1874 I had one hundred and eighty-three cases, treated after this method, and annually since that time from eighty to one hundred cases, so that to-day I have statistics of almost six hundred operations."

Following this subject, he considers quite fully calcified formations in the pulps. He says: "I find these denticles in over twenty per cent of decayed teeth, varying in number from three to more than forty in a single pulp. These are found in every part, but especially in the center, of the pulp crown; they vary in form, are spherical, oval, cylindrical and spindle shape, with wart-like surfaces. They vary in size from those scarcely visible to the naked eye to those almost the size of the pulp-chamber. In color, the smaller ones are white, with some luster; the larger are often amber color, in which the dentinal tubes are plainly visible.

"The smallest denticles have been described as mere calcifications, but we will show farther on that they are dentinal new-formations. The free denticles are not in contact with the walls, but are inclosed in pulp tissue." If the denticles are fused together they are called multiples, but if they unite to the tooth-bone they are called adherents.

"The causes of the production of these denticles have not been sufficiently investigated: such investigations meet with the same difficulties that attach to the examination of developing organs and parts.

"It is not possible to follow these processes step by step with the microscope. The development of a new-formation has a local cause, and predisposition of the tissues to secondary formations."

He discusses fully the formation of denticles in teeth not decayed and comparatively free from outside excitation; then takes up the formation of these bodies in teeth that are decayed and diseased.

Of wholly inflamed pulp, he says: "When a pulp is quite exposed and totally inflamed, its preservation is rarely possible, and it is usually attended by severe and somewhat extensive pain."

The causes of pulp inflammation, he indicates, are those with which we are generally familiar.

The illustrations, by wood-cuts and chromo-lithographs, are diagrammatic, but serve well to illustrate the points in question. Mr. Witzel has certainly given much close study and investigation to the subject. Upon the pathology and treatment of the dental pulp, it is superior to anything to which our attention has been called, and it is very desirable that it should be rendered in English at an early date.

A Practical Treatise on the various kinds of Artificial Dentures; comprising, also, useful Formula Tables and Receipts for gold-plate, clasps, solders, etc. By Mr. Chas. Hunter, of London.

This volume contains two hundred and sixty-eight pages, and is well illustrated. It is an excellent elementary work for the student, and a good hand-book for the practitioner as well.

The author takes up modes, processes and materials, and presents and discusses every subject pertaining to each in a very clear and concise manner, and yet briefly. Some methods and processes are introduced and described that are not employed in this country; from this, however, let it not be inferred that they are not valuable.

There is very little, if anything, in this work that is not of practical value. The work ought to be in the hands of every one who is in anywise engaged or interested in dental prosthesis.

Since the last meeting of this body, the second edition of the "Elements of Dental Materia Medica and Therapeutics, with Pharmacopœia," by Mr. James Stocken, has made its appearance. In the preface to this edition the author remarks:

"Anticipating the results of the noble efforts being made to

raise the intellectual status of the Dental Profession, and in view of the probability that at no distant date Materia Medica might form part of the curriculum of the dental student, I have decided to enlarge its scope; the result of that decision has been the addition of considerable fresh matter, and the volume, as now published, is double the size of its predecessor. Many corrections and improvements have been made in this edition, which make it far more valuable than the first."

The advance of the profession will doubtless ere long render necessary a more complete special work than this; and in the preparation of the next edition of this work, or in the preparation of another work upon the same general subject, it will be well for the author to bear in mind that Materia Medica already forms a part of the curriculum of the dental student. There is no special work on this subject that fully supplies his requirements, and to meet these, such works as Wood, Stillé, Waring, Biddle and Headland should be studied.

A Manual of Dental Surgery. By ROBT. BAUME, Dentist, of Berlin, editor of the Vierteljahrsschrift. With 122 illustrations.

The work is divided into ten sections, embracing the following subjects:

1. Anatomy.
2. Anomalies of the Teeth.
3. Diseases of Dentine, Enamel and Cementum.
4. Diseases of the Tooth Pulp.
5. Diseases of the Periosteum.
6. Diseases of the Jaws.
7. Diseases of the Gums and adjacent parts.
8. Neurosis.
9. Extraction.
10. Prosthesis.

The author had his attention more especially drawn to the preparation of this treatise by the offer of a prize, by the Central Association of German Dentists, for an essay on the question "What influence have the diseases of the teeth on the whole organism?" He says: "At first I had the intention to attempt the preparation of a work on this subject. I formed a design for it and gathered material, which is abundantly distributed through dental literature. To master the material, a monograph would have been necessary."

Dr. Baume, after considering the whole matter, concluded that a text-book of dentistry in general would meet the question more nearly, and be of greater general utility than a mere monograph.

The first and second sections present a very good résumé of what has been known and written upon the subjects hitherto. In section three he takes the ground that vitiated secretions of the mouth is a fruitful cause of dental decay. The hard parts of the teeth are destroyed by acids, alkalies and mechanical abrasion. In section four, on the diseases of pulps and their treatment, he gives a very good presentation, though to the close and observing reader there will be but little, if anything, especially new.

He takes issue with Dr. Witzel on the use of arsenic in the treatment of diseased pulps. He contends that it cannot be applied to any exposed pulp with an assurance that the entire organ will not become devitalized, and that generally after the use of the arsenic, reactive inflammation extends to the periosteum, though he makes no mention, and may not be aware of the prior treatment, by the solution of tannin and phenol, which seems to be an important element in Mr. Witzel's treatment.

In the excision of pulps, and the preservation of the remaining portion, he seems to have very little faith, regarding it as an impracticable mode of treatment for the general practitioner.

The question will naturally occur: If this treatment is practicable and successful at the hands of Mr. Witzel, may it not be with others? If the latter has clearly attained the results he claims, it teaches an important lesson, the value of which ought not to be disregarded.

Diseases and treatment of the periosteum are fully treated, and the views generally are correct.

The sixth section, on diseases of the jaws, occupies about one hundred pages: the principles pertaining to these affections are clearly and tersely set forth. This may properly be said of all the remaining sections.

Dr. Baume takes high ground in reference to both the science and art of dentistry. It has come to that point when it may properly be regarded as a specialty of medicine.

The details of operative and mechanical dentistry are not as fully given in this as in some other works. The work, as a whole, is valuable, and we trust an edition in English will appear at an early day.

"*The Origin and Formation of the Dental Follicle.*" A histological treatise, embracing the evolution of the teeth and associate parts. By Drs. LEGROS and MAGITOT. Published by Jansen, McClurg & Co., Chicago.

To this work your attention was briefly directed in the report on literature of last year. At that time it was only in the French language. It has since been translated into English by our worthy and highly esteemed fellow member, Dr. M. S. Dean. This is an exhaustive treatise upon this subject.

The tissues from which the teeth originate, and the progressive stages of development, are minutely described and amply illustrated, from their incipiency to the completion of the dental follicle. This covers the ground that had been only partly explored by previous investigators. These authors have here undertaken the most difficult task that the embryologist has to deal with, in connection with the development of the teeth. In addition to the human embryo, their investigations have been made upon large numbers of those of the different species of domestic animals.

The authors begin their descriptions with the elements that constitute the external structure of the mucous membrane, and at an epoch anterior to the full development of the subjacent tissues; thence tracing their history, step by step, in the formation of the enamel-organ down to the period at which the dentine-papilla makes its appearance. They then describe the progressive stages of these and the surrounding tissues, both separately and as a whole. In this way they give to the reader a very complete idea of the character and mode of development of the histological elements that enter into the constitution of the teeth. In all the morphological changes that take place in these cells, and the different physiological functions they are called upon to perform, the *primitive origin and character* of these elements are always kept prominently in view. The physiology of these parts is considered in connection with their histology and with the same thoroughness of research and minuteness of detail.

While many authors have described the process of development of the hard tissues,—the enamel and dentine,—the stages of evolution prior to the formation of these have been left in comparative obscurity; the origin and development of the enamel-organ, the dentine-papilla, and the adjacent parts, having been passed over

lightly, and without giving a definite idea of their embryonal phenomena. From this treatise, therefore, we get a clearer insight into these occult processes of evolution, than from any other work.

The Translator's Introduction occupies about forty pages, and treats of the mucous membrane, the growth and decline of Meckel's cartilage, the inter-maxillary bones, etc.

The description of the mucous membrane and the terminology used are very much simplified; and with the aid of the diagrams and cuts, the elements from which the enamel-organ originates may be easily understood. The writer gives a clearer and more intelligible idea of the position of the layers of the mucous membrane and their elements, especially those from which the enamel and dentine are derived, than has hitherto been presented. This description was not necessary for such as are familiar with the minute anatomy of these parts, as those were supposed to be for whom the work was originally written; to many, however, who have not gone over the ground thoroughly, it will be found a valuable aid in clearly comprehending the subsequent treatise.

The article on Meckel's cartilage is exceedingly interesting and instructive. A description of this organ is given from its first appearance as a temporary support to the lower jaw till it finally disappears. This account of a structure very little understood in our country is made additionally clear by cuts drawn from nature by Magitot and Robin, and the translator. It gives a more definite idea of this organ than is elsewhere found in the English language.

The original treatise is amplified by the translator's explanatory notes, in which the views of many of the more eminent authors have been introduced; generally favoring, but sometimes dissenting from, the views advanced in the text. From these the reader will gain considerable knowledge of the recent literature upon many difficult and disputed points in the evolution of the teeth, which he would otherwise find it difficult to obtain. This we consider an important feature of the book.

"Although the work may not be considered as a 'practical treatise' in the ordinary acceptation of the term, yet it contains valuable lessons, which may be applied in preventing the disastrous consequences of those exanthematous diseases which are so liable to arrest or pervert the nutritive supply to these develop-

ing organs, and which often result in the disfigurement, and sometimes in the entire loss of the teeth. Hence, its suggestions should not be confined to the dental surgeon alone, but should be made available by the medical practitioner, who, at the present day, retain almost undisputed possession of this sadly neglected field of practice."

The book is illustrated not only from the very superior cuts copied from the original (which represent to the eye the various stages of development more fully than any preceding work), but also by several that have been added by the translator, of which some are drawn from nature and some are selected from the works of recent authors.

The translator has achieved the difficult task of giving the exact sense of the authors, so far as we have been able to discover, and at the same time of presenting their ideas in language entirely free from the harsh and inelegant style so common in translations of scientific works. For this, and for the entire undertaking, he is entitled to the thanks of all who desire to see the profession of dentistry resting upon a scientific foundation and legitimately entitled to rank among the learned professions; and if the work is properly appreciated, it will soon be found in the hands of every dental practitioner and student in the land.

In the future let the literature of our profession give evidence of development, growth and progress, equal to that which is so palpable in almost everything else that goes to make up our profession.

DISCUSSIONS.

Dr. Bödecker: I would like to say a few words with reference to the work of Dr. Witzel, which was referred to in the report. I have read it very carefully, and think it contains many mistakes. In reference to treatment with arsenic, the author says the action of arsenic in a healthy pulp is altogether a superficial one. I think he could not have seen the effects of the action thoroughly, because the way in which he prepares his microscopical specimens is rather a queer one. He takes out the pulp, lays it upon a slide with glycerine and then puts the cover on. It is all right to examine such a preparation with a power of ten or fifteen diameters, as he does; but he will only be able to see the outer surface of such

specimens. The minute changes that have occurred by the action of the arsenic within the pulp cannot be seen by this examination. Therefore, I think some of his statements are rather hypothetical. He says that no pulp has ever been saved by an oxychloride capping. A relation of mine wears a canine tooth which I filled about seven years ago, and used oxychloride for capping the pulp. Two or three years later I removed the filling and found the pulp healthy, though not covered with a new deposit of secondary dentine. I capped the pulp the second time with creosote and oxide of zinc, and filled the cavity with oxychloride. A year or so after I saw the tooth again, and the pulp was still alive and in very good condition, but not covered by secondary dentine yet. I think this proves that one pulp, at least, has been saved in that way. I have seen many others that Dr. Atkinson has saved in the same way. Dr. Witzel claims that he has a method of capping with diluted carbolic acid and oxide of zinc, evidently thinking the Americans never have used anything but oxychloride to cap pulps with, and that this method is quite a new idea, originating with him. Every one in this country knows that pulps have been successfully treated in a variety of ways. Five or six years ago Dr. Atkinson showed me many different methods of capping pulps. The drawings in this work are executed as beautifully as any drawings or litho-photographs can be. They have been made by the celebrated Dr. Joseph Heitzman, of Vienna, a brother of the renowned Carl Heitzman, of New York. These drawings show one or two arteries in every pulp, which, in the upper portion of the latter, ramify like the branches of a tree. I have examined a number of pulps, but I have not been able to see one such artery. I will not say that there may not be arteries within the pulp, because I have not seen them, as in making a section of a pulp I might have lost just that portion of it which contained the arteries. I hope soon to have time to experiment a little more with arsenic, as well as pulps.

Dr. SPALDING: What is the character of the blood vessels that convey the blood within the tissues of the pulp?

Dr. BÖDECKER: Capillaries.

Dr. SPALDING: No veins in them?

Dr. BÖDECKER: I could not distinguish any. I have never been able to find the least trace of muscular fiber within any of

the vessels of the pulp, but I do not say that there are none, because I have not studied them closely enough to be able to make a positive statement. I have had a microtome made for the purpose of cutting pulps, so that I shall be able to get every section. In this way I can save the entire pulp without losing even the smallest part, and then I shall be able to say whether there is an artery in the pulp or not.

Dr. WERNER: If there were no arteries in the pulp, how could we have palpitation of the pulp?—which I have seen three times, to my recollection, as distinctly as pulsation can be felt at the wrist. I have always taken it for granted, and do now, that it is absolutely necessary that there should be large arteries in the pulp.

Dr. BOGUE: Our friend, Dr. Atkinson, squelched the entire First District Society in New York lately by speaking of "that exploded system," or "that exploded idea of arteries in the tooth pulp." I confess I felt myself extremely ignorant, having always supposed there were such, and I was told by six or seven others that they were in the same condition. I would like to ask those who have investigated this subject to inform us whether the term artery is to be applied to a vessel having three coats, or whether we may apply it to one with two, or possibly with one? I have not been able to get any definition of the word artery, as used in this connection, although I have asked two of these gentlemen in private. I, too, have seen the pulsations just spoken of, and Salter goes one step further and states that he has seen striated muscular fiber in the dental pulp, which I understand is the difference between what Dr. Atkinson would call an artery and what he would call a capillary. I am so much in the dark, and having sought in vain for light in the books, I venture to ask the gentleman to give us light here? If Mr. Salter *has* seen muscular fiber in the dental pulp, the fact that Dr. Bödecker has *not* seen it in a rather extended examination of pulps does not explode the idea.

Dr. BÖDECKER: My discrimination between an artery and a capillary is, that the former contains a distinctly visible muscular coat — the latter is composed merely of flat endothelia, and I have never seen a vessel in the pulp which had any muscular fiber at all, but I do not say that there might not be one. I have myself seen the pulsation of pulps. The arteries that go in at the apex of the fang sometimes divide, as I have seen them, into a very close capillary network.

Dr. BOGUE: I would like to know whether fœtal pulps have ever been examined.

Dr. BÖDECKER: I have examined some few fœtal pulps, at the base of which you sometimes see an artery and a great abundance of smaller vessels, but in adult pulps I have never seen an artery yet.

Dr. BOGUE: It is simply a question of the name to be applied for the continuation of the same vessel.

Dr. BÖDECKER: It is whether the vessel remains there.

Dr. BOGUE: If it enters an artery, as I understand you, it may become, in a very short distance, a capillary, by losing its coating of muscular fibers?

Dr. BÖDECKER: It loses its character, too.

Dr. BOGUE: But still remains a pulsating vessel.

Dr. BÖDECKER: The capillary cannot pulsate, but the flush from the artery, which is so very near, by the pressure of the blood, may cause pulsation in the pulp.

Dr. BOGUE: I have asked so many questions because Dr. Bödecker is decidedly an authority.

Dr. ATKINSON: Any embryologist living, that is worthy of the name, will not take the ground that there are the three divisions or classes of vessels in a dental pulp; and any individual who is an anatomist, even cursorily, will be able to see that there are many vessels coming in at the base of the pulp before the alveolus is formed, that continually coalesce in it, by retrograde metamorphosis as the dentine is formed, so that in many instances we may have one, two, three, four or five foramina at the end of the root of a tooth, and not an artery in any one of them. Those large vessels that you see in the pulps are nothing but what we call sinuses, in embryological investigation. If we were to pay sufficient attention to the investigation of nature, we should be better entitled to ask questions, and in a better receptive mood to accept the truth when it is presented. We have just as good instruments in the United States to apply to such investigation, and the very best lenses made in the world, and we should investigate for ourselves and not handicap our minds with the false interpretation that pertains to every book on histology yet published that I have ever seen. I wish to enable you to have in your minds something like a definite formula, whereby you might distinguish between

the three classes of vessels: arteries, veins and capillaries, and to show you that they all begin in larger sinuses that are the predicate of "blood islands." I have seen in the egg of the hen seven or eight blood islands, all beating like hearts, spinning out until they were finally reduced to the normal number of islands that constitute the cavities of the heart, thus originating it. I wished to say that much, so that I might make a remark or two that would fasten upon your minds, and then ask you if you ever saw an artery that was enlarged in size as it goes from the heart, according to the morphology of its original formation — enlarged from any point distant from the heart? Now if that is true, then there is no artery that normally does enlarge so as to be present in the pulp of a tooth; what are you going to do with an artery in the pulp — since there is the small foramen that you have been time and again told by histologists has one or two arteries and two or three veins? If you will bear that in mind, you will perceive that there is no case where the artery enters the end of a pulp, and has the requisite three coats to its caliber.

What would follow extractions, and why do teeth sometimes continuously bleed when you take them out? Plenty of men have seen cases in which they were bothered about stopping the hemorrhage. The reason is there is no artery there; if there had been an artery, and it had been broken, the longitudinal fibers would have contracted sufficiently to have closed up the end of the artery; but being capillary, when extracting the tooth ruptured it, it left a little funnel-shaped, patulous mouth.

I wish to say something about the foreign literature that we are so crazy about, simply because distance lends enchantment to the view; and we would rather take the word of somebody else that sayings are true than to investigate for ourselves. The very nomenclature of Witzel and that other man indicates to me that they are men who have received their degrees by way of accommodation; that they must have bought one of Buchanan's tickets of scholarship along with a sort of addendum that indicates his ignorance, in the way of a diploma.

REPORT OF SECTION THREE

ON

NOMENCLATURE AND TERMINOLOGY.

By W. H. ATKINSON, Chairman.

TO those who have carefully studied last year's report, prefatory remarks are unnecessary; but to those who have not seen it, some little detail may be a means of inviting patient and close attention to a subject which the world has boggled over for all time. My own preconceived preference for things old and accepted by teachers and scientists long stood in the way of my own consideration of a subject which seemed too deep and occult for ready apprehension by even the best efforts of the best minds. After much struggle to adequately express myself to my brethren about things clear to my own apprehension, with but slim acceptance, I have at length become convinced that the only successful method of arriving at a sure foundation for correct pronouncement of our mental labor is to pursue the following studies of basic science growing out of the discovery of universology.

Returning to the point of commencement in these new technicalities, as made in last year's report, further experience suggests one or two slight amendments in the form and use of the terms then employed. In describing the four grand universological varieties of Form: Punctiform, Liniform, Planeform, and Solidiform, it is found that the third of these — Planeform (form made up of planes or surfaces) — does not get the pronunciation which is intended from this mode of spelling. It is apt to be called Plane-form, in two syllables, while the spoken word is three syllables, like Liniform and Punctiform. This would be partially remedied by changing the connective vowel e to i, making Planiform; but such is the peculiar kinkiness of English spelling, that this change

would cause another change in the sound of the vowel of the first syllable; and the word would then be pronounced as if its first syllable were the word *plan*. This would cause a false impression, and must be avoided. The true pronunciation is given thus, plane-i-form; but we cannot rely upon such an unusual method as the introduction of two hyphens. Fortunately there is a device which is not so violent as this. The English root word here is habitually spelled in two ways, *plane* and *plain*. This is one and the same word with variant spellings; but, as in the case of proper names, Clark and Clarke, or Smith and Smythe, a prejudice arises in favor of one or the other spelling, as the more aristocratic, so *plane* has obtained a sort of fixed preference, wholly without reason, as the geometric or scientific term, and *plain* is the democratic or ordinary orthography. We shall have, on this occasion, to conquer our prejudices and write the word in question Plainiform, in order to secure the desired pronunciation without resorting to hyphens. This is a fair instance of the infinite difficulties which we suffer from the unphonetic character of English spelling, and which we should escape if the spelling reform were to prevail.

It is not expected that these novel and precise new technicalities will be adopted and made familiar at once by more than the very few who make a specialty of the subject; but, being in existence, and having a philosophy, they may be taken up, one or two at a time, by authors who find themselves in straits to express their ideas more precisely than they are able to do by the use of the old terms, and thus gradually be introduced to the public. The old fountain-head of technicality has been the Greek language; the new fountain-head is the scientific universal language (Alwato) which the universologists are elaborating for this express purpose. A short account of what universology is, and of its methods of forming words, will not, therefore, be inappropriate.

Universology is the one science, embracing in a sense all other sciences, which grows out of the discovery of the fact that one and the same set of laws and principles underlies all the sciences, so that similar distributions are made, first of the universe or world itself into the fields or domains of the special sciences; and, then, of these particular fields, internally. The ground covered by each science is, in other words, amenable to the same general system of the division of its parts as that cov-

ered by any other science, a fact which opens the way to one universal system of scientific technicality. To conceive of this unity in the midst of the utmost diversity let us compare two departments of science so wholly dissimilar as the science of language and physiology (*i.e.*, macro-physiology, including anatomy, physiology, and hygiene). Both of these sciences concur in having a fundamental threefold division into 1. A stationary aspect or department, the investigation of the thing as it now is, or apart from any changes; 2. A transitory or motic aspect or department, the investigation of the changes which it undergoes from time to time, or moment to moment; and 3. A complete or perfect aspect resulting from the combining of the former two, and which makes the *whole*-th, or health aspect or view.

The first of these yields, in respect to language at large, the science of universal grammar or the logic of language, which is permanent or fixed in whatsoever language and at whatsoever stage of lingual development. This is, therefore, the osteology, or more largely, the anatomy of language. The second yields the developmentology and physiology of language, lingual history, etymology, etc., which are specially related to time and eventuation or the on-going in time—the *motic* as contrasted with the *static* aspect of things. Finally language has its diseases ("phonetic decay"—Max Müller, etc.), hence its pathology, and hence its therapeutics or restoration to health, and hence again its hygiene or its means of maintaining itself in health or *whole*-th, or, what is the same thing, in its normal condition.

On the side of macro-physiology it is now obvious that it is the anatomy, physiology and hygiene of living objects which are here so accurately repeated in the apparently unrelated region of the science of language. It is precisely the same in any other sphere. These differences of static, motic and dynamic (this last meaning potency or health condition), and other similar primal conditions of being, apply equally to every department of being, and consequently to every science. It is this fact, and the recent discovery of it, which render possible, and which *found*, the new science of Universology, *the one science which underlies and unites all the other sciences.*

To restate; for, in a matter so important and so new, a little repetition need not be shunned: It is the first of these universal

principles—Statism—which presides over, and is, as it were, concretely reproduced in anatomy; the second of them—Motism—which presides over and is concretely reproduced in physiology; and the third of them—Stata-Motism, Dynamism or *Tug*-f (for *tug*-th), whence *tough*ness, health or *whole*-th — which presides over, and is concretely embodied in, hygiene.

Not only do these three fundamental principles, statism or the spirit of rest, motism or the spirit of movement, and dynamism or the spirit of tug, exertion or effort (power and force), permeate the totality of every sphere of being, and of its appropriate science—language or living beings for instance—but they are all repeated, pivotally and centrally, in that which is pivotal and central within the given sphere. The verb is this pivotal or central object within the sphere of language, and man ("the word" or *verbum* in a mystical sense) is the pivotal or central object within the total sphere of living objects.

Usually it is said that the verb means *to be*, *to do*, or *to suffer*, (this last specification meaning *to be acted upon*, or *to be the recipient of an action*); but this is not quite the inclusive statement. Let us say rather, 1. *To be* (the neuter or static verb); 2. *To do*, to move objectively or toward the object (the active voice), or *to suffer*, movement subjectively or toward the subject (the passive voice) (phases of the motic or active verb); and 3. *To do and suffer*, action and counter-action, co-acting in a mutual reciprocity of strife; the reflective and reciprocal verb (he strikes himself, they strike each other).

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In respect to the new technicals recommended in last year's report based on the root *punct*, to denote roundish, point-like, minute objects or concepts, no change is found to be necessary. The following enlarged list is now submitted, along with a series of diagrams, which will be found, it is believed, remarkably adapted to illustrate both the histological evolution and the potency of the new system of technicalities to follow, by its own corresponding evolution, every step in the series:

- PUNCT-IT, a geometric point, an unpronounced atom.
- PUNCT-ID, an atom; the least pronounced portion of matter, as a concept.
- PUNCT-IS, a flock of punctits; a group of geometric points; or, by license, of a minuter order of atoms; of lighter or

finer atoms (following the lead of the mathematicians who conceive different orders of the infinite); A MOLECULE (still, like the atom, uncognized by our visual sense).

Punct-iz, a flock of punctids; an aggregation of heavier or coarser atoms; A GRANULE, the first visible body under the lens.

Punctits (pl. punctitses), a pivoted or nucleated flock of thin or light atoms; an unpronounced corpuscle, *ghost-like.*

Punct-idz (pl. punctidzes), a pivoted or nucleated flock of heavy atoms; a pronounced corpuscle, body-like.

Punct-ish, the light filamentous corona surrounding a vacuole or empty space, implying an unrevealed central point.

Punct-izh, the heavy beamy corona, surrounding a vacuole, implying a revealed central atom.

Punct-it-sh, filamentous-radiance-bearing unpronounced atom.

Punct-id-zh, filamentous-radiance-bearing pronounced atom.

Punct-is-sh, is punctis, *plus* filamentous radiancy; molecule, with filamentous corona.

Punct-iz-zh, is punct-iz, *plus* beamy radiancy; granule, with beamy corona.

NOTE.—These two words have for their plurals punct-is-shes and punct-iz-zhes. It is to be observed that Alwato, this new technical language, growing out of universology, provides words which, by their analogy, correspond with obscure or half-occulted objects by similar difficulties in the pronunciation. If, therefore, these two words are unpronounceable, except after phonetic training, so are these histological concepts, which they name, *unpronounced*, except after this close analytical treatment. The plural forms are a little less difficult, as mass-presentments are more *pronounced* than elementary units.

Punct-it-s-sh, filamentous-radiance-bearing corpuscle.

Punct-id-z-zh, beamy-radiance-bearing corpuscle.

COLLECTIVE EXHIBIT OF THE SYMBOLS.

DISCUSSIONS.

Dr. ATKINSON: In hopes of arriving at the basis of fundamental activity in spirit and in body the section has labored arduously, and permit me to say successfully, in giving the first postulates that stand in relation to science in general and science in particular ahead of the alphabet of any known language. Their efforts were directed toward getting at *the* foundation and not *a* foundation. Sound is the basis of all verbal communication from one seat of consciousness to another, and is naturally divided (that is, the sound produced by human vocal apparatus,) into thirty-two distinct compartments—that is to say, eight sounds and twenty-four stops. The verb has eight aspects and each one of these aspects has a specificity of meaning in itself natural, and this is the discovery in sound, and the language that presents it is called Alwato and Tekewa.

Following out the lead of this order of phonition, those who have studied short-hand will be better able to comprehend the discriminations made than those who have paid no attention to spelling and pronunciation by other means than simply memories of the repetition of the sound they try to imitate from some other organ or voice. It would be too much of a work to show why there are just eight vowel sounds, and that what have been called consonants have no sound at all. They are simply stops in vocalization that differentiate the stream of sound, so as to differentiate it in specific methods of communication of emotion, or the concept of the mind or feelings. There are twenty-four of these stops that will be nominated in the pursuit of the further projection of the discovery in universology. Now the departure that I would most firmly commend for study is the organization of individual bodies. All naturalists have consented that we must have a starting place, and that starting place has been called an atom, but that was the pronounced atom to be sure. It is a body that is only conceived in the mind, and if you will now follow me I will give you the nomination of these bodies, the representations of which I have on the blackboard.

The first very thin, light point—dot—represents the unpronounced atom, or the *punct-it*, and is represented by this thin, light, indistinct presentment. Then when you take the same body,

enlarged so as to be heavy, that is a *punct-id*, and is represented by this point. A point is position in space, without length, breadth or thickness—that means neither the ghost nor the idea of the point, the movement of mentality, the consciousness that foreshadows the presentment of that which shall be clearly impinged upon the tablet of the mind, so as to have an idea of distinct reality. *Punct-is* is a group of punctits, a group of geometric points. Here we have the lead of mathematicians who conceive different orders of the infinite, and that represents a molecule, an unseen body which is like the atom, uncognized by visual sense. *Punct-iz* is the next order, and is the pronounced molecule. *Punct-iz* is a collection of punctids, an aggregation of heavier or coarser atoms, the first visible body under the lens, not visible to the ordinary visual apparatus, the unpronounced granule or molecule. *Punct-il*, a pivoted or nucleated flock of light atoms, an unpronounced corpuscle—and this is ghostlike. We come then to this next figure, which is simply this one in such form as to be presentable in the more distinct and discernible presence, *punct-idz*, a flock of heavy atoms, a pronounced corpuscle, bodylike. The next is *punct-ish*, the light filamentous corona, surrounding a vacuole or empty space, implying an unrevealed central point. *Punct-izh*, the heavy beaming corona, surrounding a vacuole, implying an unrevealed central atom; that is to say, these two represent the vacuole in its unpronounced and pronounced presence. Then *Punct-itsh*, filamentous, radiance-bearing, unpronounced atom here, the ghostlike presentment or the thin light, with the forms of filamentous radiance about it. The heavy one is *Punct-idzh*, filamentous, radiance-bearing, pronounced atom. This is the ghost and that is the body. The next is *Punct-is-sh*, filamentous radiance. This is the molecule with filamentous corona, with a flock of punctids and with radii about it. The next is *Punct-iz-zh*. These two words have for their plurals punct-itshs and punct-itzhs. *Punct-is-s-sh*, that is, filamentous, radiance-bearing corpuscle; and the next is *Punct-id-z-zh*, beaming, radiance-bearing corpuscle. That is the *amœba* that is the *corpuscle*, sometimes called the embryonal corpuscle, sometimes called medullary corpuscle. Having patiently traversed this whole question, from the standpoint of the text-books, we are driven by the inspiration of our necessities to indicate the universe, or cen-

trality, or consciousness, in seriated movement that signifies mentality, whereby steps are grouped together and coherently packed into: *First*, The ghostlike presentment or ideal from the type, and afterward gather the molecular mass into such divisions or centers as to present us with this, that is acknowledged to be the first form of living body, the *amœba*. I have only a few more words to say, and then will hold myself ready to answer any direct question. I wish to express my great joy at the attention shown last night and this morning to a question so occult, so ghostlike in its presentment, and I prophesy that before ten years shall pass that this body will be acknowledged, by scientists worthy of the name, to be the highest body for the untrammeled presentment of truth. Last year the basis of all this was presented in the report of this section in giving what we challenge the sharpest intellect of the world to contradict: Point, line, surface, solidity, discriminations, that are in nature and patent to every one capable of thinking at all. That was the basis, the four-legged little stool upon which this seven-legged stool was placed. Each one of these has a dual aspect, but there are but seven of the completed bodies, therefore we find that we are all the time dealing with what is called duplicity. If we live we will take the next regular step in the order and add further demonstration of the revelation of truth respecting mental action, scientific coherency, mentality, at our next convocation.

Dr. SPALDING: I want to ask Dr. Atkinson one or two questions. One is, whether we are to understand that the first form, punct-it, is a substance?

Dr. ATKINSON: Very sharply queried. Everything is a process of emotism and motism. It is substance and it is energy in every instance. Now, what is the concept of matter? It begins with the granule, but we will see that every motion comes out of emotion, and every motion is in some kind of physical body, so-called by the old language; there is no matter without spirit, and there is no spirit without matter.

Dr. SPALDING: The last aphorism announced by our friend seems to me a very estimable one. I do not think we have anything directly to do with spirit in our profession. There are material substances out of which the material world is composed, and we are studying the laws of those substances, and there are

spiritual substances out of which the spiritual world is composed, and we do not propose to study the laws of those substances. That there has long been felt a want of some positive system, some plan, grade by grade, and step by step of the whole process of the evolution of material substances by the action of material forces, is most evident. I thank our friend Atkinson, who is working in that direction, that he has started upon a philosophical basis, in appealing to nature for the laws which shall govern the system which he is endeavoring to develop, and he is making very strong headway, too. Everything is produced by the action of two forces. You can make nothing new except by the coöperation of the two forces, male and female principles, and they exist in the Creator just as much as they do in created things. The very fact that the dual relation exists in the Creator accounts for the fact that it exists in created things. So that it is very delightful to my mind to see that this investigation has brought me to a conclusion that there are seven distinct progressive steps in these processes and that each of them has a dual property. I have no doubt that our friend will work out something valuable from these points which have just been made.

Dr. BARRETT: This matter of terminology is a subject new to me. If I clearly comprehend the central idea of it, it is that there is an actual and an ideal; that the first central is ideal, the *punct-it* is ideal and the *punct-id* is actual and material, but that the whole matter has anything to do with spiritual force I cannot see. An atom, although it is real, is not demonstrable. We can have no clear conception of what it is without passing into the realm of metaphysics. When we come down to granules we are then in the actual, because a granule is something which can be clearly demonstrated to the visual organ. For the study of physics, as for the study of metaphysics, it is necessary that we have a definite nomenclature; something that is precise and concise, so that when we listen to another, who is speaking on scientific matters, we shall know precisely what is meant.

There is a difference between the concept of the atom and the atom itself, although neither of them can be demonstrated. There is a dual relation; the one is simply the mental image of the thing and the other is the thing itself. In the consideration of these matters we have no fit terms in which to express ourselves. My

present inability to definitely and satisfactorily explain my meaning is because of the lack of the words which this terminology would supply. We cannot definitely speak without using the very terms which Dr. Atkinson suggests, but which are as yet too strange to be at our command. Viewing it in this light we can catch a glimpse of the importance of this immense stride in the direction of a concise, clear nomenclature.

Dr. FRIEDRICHS: I would like to ask one question. We all know that there is a conception of the ideal. We all know that the sun is distant from us about 95,000,000 miles. In connection with this, will the human mind ever be so illuminated as to locate the end of the first mile in the 95,000,000?

Dr. ATKINSON: That is a very intelligent inquiry. Our point of departure is our earth—the inside. The inside and the outside is in every one of us, so that we become, the moment we think at all, the center of the microcosm of the infinite world, of the absolute universe, that is the outlimit. We are to all intents and purposes the center, and then it is from the point at which we stand that we begin our measurement; and how do we arrive at that? We arrive at it by the operation of emotism of our mentality being segregated in consecutive relations of modes of motion, so as to determine certain things that convince us whether we will or not. We cannot believe at will anything at all about it; we have to have the testimony and we do not possess it—it possesses us. How do we get that measure? By the paralax of the stars having been taken and the calculation made. We began with the unit by which we calculate our measure here, and so made out the sun's distance; and they have reduced it from 95,000,000 to between 93,000,000 and 94,000,000 miles. What was the whole country engaged at, and why did all the civilized nations send deputations to take the transit of Venus last year?

Dr. FRIEDRICHS: That does not answer my question. Will the human mind ever be so enlightened as to comprehend it? This is simply an hypothesis of Dr. Atkinson's. In his diagram he gives us a series consisting of seven steps, each step having two divisions. Now, how are we to know that there are only seven steps, with their divisions, in the progression of this ideal point? May there not be 1,400 series instead of fourteen? Other minds have their ideal points, which may deviate a thousand times from his ideal.

Dr. ATKINSON: That is precisely what this discovery claims to be,— universality — that is, inclusive science, by which all the other sciences can be clearly demonstrated.

Dr. FRIEDRICHS: I am very glad that the doctor has taken this subject up, and I thank him for the able manner in which he has demonstrated it, even though I do not coincide with him, nor think him correct in his hypotheses.

Dr. WERNER: The question is whether this proposed terminology will help us to grasp that which we have not been able to before, the same as the molecular theory enables us to explain certain things which we could not comprehend without it; whether it is a convenient terminology to explain the material from the spiritual. We must necessarily always differ in certain things; the spiritual here is after all of little importance compared with the material. This is a material world, and we have so much in it which challenges our attention, that it seems almost folly to care so very much for the spiritual. When we get to the spiritual world we shall attend to things there.

REPORT OF SECTION FOUR

ON

OPERATIVE DENTISTRY.

By ISAAC J. WETHERBEE, Chairman.

A COMPILATION of the rules and systems of practice of the "ten thousand" (more or less) practitioners of dentistry in the United States would present a condition of things that would awaken the greatest possible surprise, so diverse are the views of dentists as to methods to be employed to obtain a specific end.

If there was *unity* in this *diversity* a satisfactory personal record would ensure a complete justification. In the absence of such record we are forced to the conclusion that there is, at the present time, a dearth of scientific knowledge requisite for a skillful practice of dental surgery—knowledge of the true character and functions of dental tissues obviously required—the proper methods of procedure to conserve, to the fullest extent, their usefulness.

It appears that late events—events characteristic of the age in which we live—have unsettled, or at least disturbed, the convictions of many, which had matured from long and careful observation. Why this sudden change? One might reasonably suppose that a *messenger of light* from a higher plane had at last condescended to give us a "new dispensation."

Let us in a few brief words examine the *salient points* of this "new departure," and see if there is anything really "new" about it, and if so, in what it consists. It is acknowledged by the chief apostle and other expounders of the "new departure" that in *well organized teeth* gold should be employed as a suitable material. In the "Dental Cosmos" for July, on page 376, we have the *true inwardness* of this latter-day adventure set forth with an unction that is exceedingly refreshing. Hear what it says:

"We desire that you should observe *how little, how very little,* we have asked that you should deviate—at first—in practice from that which is usual practice."

"We say, *fill all you can and do,* SATISFACTORILY WITH GOLD! *It is so stated in the bond!* Can you, in turn, ask anything more? Why do you desire to fill such teeth as you cannot fill 'SATISFACTORILY' with gold with that material?"

Is there anything "new about that"?

"But the truth is that the 'true inwardness' of the 'new departure' is a very different thing from this. Its design is to teach a principle which shall indicate lack of knowledge as the cause of '*failure in operations,*' instead of attributing it to defective manipulation."

This audacious assumption! this begging of the whole question, especially after ceding the fundamental principles which underlie dental practice as generally understood, is quite enough to make angels weep, if they have *tears to spare* for the washing away of such folly!

We are *advised* to fill all we can satisfactorily with gold. Why? Because gold makes a good and durable filling in the majority of teeth, notwithstanding the *assumed want of compatibility of gold with dentine.* How shall we determine its compatibility with dentine? Because teeth again decay after having been well filled; and from the same cause or causes which produced the first lesion are we to legitimately infer that the chief factor in this newly recurring disaster is to be charged to want of compatibility? Oh consistency, thou art a jewel!

Again, "it is the *little,* yea, the *very little* deviation that they have asked at *first* from that which is usual practice." Now, why all this? If gold is radically wrong in the *one case* for the want of compatibility, why not in another? And how is it about the *little* departure? Why not away with it at once and make it contraband? The incongruity and fallacy of such teaching is quite enough to indicate a relish for the leeks and onions of Egypt.

The enunciation of the plausible theory of chemico electro galvanic action produced by gold being in apposition to dentine, and producing decay, has had its day of small sayings without proofs, and is seeking a retired place for silent *interment,* for the reason that it could not find either god-father or a reliable god-

mother as sponsors to assume the responsibility of its future well being, as it had no established scientific basis on which to depend.

We are informed that the *true inwardness* of the "new departure" is a very different thing from this. Its design is to teach us *how little we know* of the cause of "failure" in operations. This gratuity on the part of one who was possessed of this specific knowledge for eighteen or twenty years, but retained it within his own bosom until recently, is quite overwhelming. At least it seems that his bowels of compassion for suffering humanity were not moved until the fullness of time as approved by himself had arrived.

Is it not true that dentists in their practice are eclectic? Have they not, as a general thing, filled such teeth with gold when the quality of the tooth indicated its use? Have they not used amalgam when, in their judgment, the usefulness of the tooth could best be preserved thereby? Have not the oxychlorides and tinfoil had due prominence in the economy of dental practice? When doubt has existed as to saving the teeth by the employment of either of the above materials has not a resort to extraction been a reasonable practice?

It is true that many teeth have been sacrificed in the past, and will be in the future, for lack of knowledge and because of a prudishness as to reputation. Dead men tell no tales (not true, however), and their escape from implied indiscretion, by reason of the failure of some operations, is a personal satisfaction. It is reasonable to suppose that the employment of the above mentioned materials is due to a conviction that a tooth may be preserved longer and be more useful, and this from a *knowledge* of the *relative conditions* of the case.

It is a generally well known fact that "gutta percha" will preserve a tooth so long as it shall remain intact. Six months or a year will suffice to disintegrate such fillings in the teeth of patients whose oral secretions are viscid. In other and diverse cases these fillings will be worn away by attrition within a comparatively short space of time. They must be *frequently repaired.* Each sitting for repair is an additional expense to the patient, and in the lapse of one decade will aggregate a larger expense than would have occurred provided they had been filled with gold in the first instance, to say nothing of the loss of time. Let us not forget or

be unmindful of the frequent repair the "new departure" system subjects patients to.

It is my intention in this report to voice the general sentiment of dentists so far as I have been able to obtain their views; and give, as far as possible, an opinion which many years of intelligent practice has confirmed. I believe that no practical man expects to save all the teeth which he fills for a definite period. It is understood that although cavities in the teeth may be filled, *and filled perfectly*, we have little, if any, control over the causes which first produced the local destruction of dental tissue. Decay may seize any other portion of the tooth, or, indeed, may waste away the enamel and dentine in proximation to the gold.

Again, other teeth, which were not decayed when the above cases were treated, are found, after three or four years, decayed, not by the apposition of gold thereto, but as the result of viscid secretions or fluids, and perhaps for lack of proper care of the teeth. In such cases we have no use for the hypothetical; the evidence is clear and conclusive. So far as my knowledge and observation extend, there are few converts to the so-called "new departure."

I deem it proper in this report to give a brief summary of what may be considered general practice. The *contourist* claims that in good tissue the lost portions should be restored to nearly or quite the normal size, believing that nature, in her economy, is to be followed in order to secure the best practical results. My convictions and practice are in perfect accord with the theory above expressed. Operations of like character performed over twenty years since, are good to-day, and conclusively demonstrate the practicability of this style of practice.

We have the *radical separatist*, who, with file and chisel, cuts away both good and poor tissue alike, making no discrimination, leaving the teeth in a sadly demoralized condition. The excuse offered for this is greater facility in operating, larger degree of cleanliness, and less liability to decay. In poor teeth this practice is quite justifiable; indeed, the condition of the teeth as to quality makes it necessary, as the teeth can only be saved, if preserved at all, by this method. But why extend this practice to good and well organized teeth?

We have next in order the *more moderate separatist*, who is care-

ful to secure a sufficient general separation; but is also careful to give a much wider space on the lingual approximate surfaces, for the purpose of making the space self-cleansing, thereby retaining the good appearance of the tooth. This practice, so far as conditions may indicate, is to be approved and commended. The surfaces in such cases should be well polished.

Gold in the form of *pellets*, if non-cohesive, is well adapted for use at the cervical wall, and in large or small crown cavities cylinders are admissible; by some they are preferred. For the general use of cohesive foil I prefer ribbons, made by folding a sheet of No. 4 so as to make eight thicknesses, and then cut into such sizes as the case shall require. Gold in this form is adapted to cases where but little room for convenient operating is obtained, as it is very portable. The method of impacting, etc. etc., are too well known to be rehearsed in this paper.

Let us consider the claims which some of the "bleachants" now in use have upon our confidence. Chloride of lime, or, more properly speaking, *chlorinated lime*, has been used for bleaching discolored teeth. It has, however, fallen into disuse, for the reason that, although at first its use was satisfactory, future results did not justify its application. Chloride of sodium is open to like objection, from the effect produced upon the calcareous portion of the dentine, as well as upon the soft tissue. A grayish-yellow shade will appear within a short time, or at best within a few months.

Strong *spirits of camphor* is an excellent bleachant; it is very effective in a short space of time. It dissolves the pigment within the cells, as well as permeating the hard tissue, leaving no bad results. So much of the dentine should be removed as may be safe to do. The rubber dam should be in position, and the spirits of camphor applied for such time as may be requisite to attain the end desired. Then fill the *root* with gold in all cases. Fill the cavity with great care and thoroughness, and you will be well pleased with your success.

There has not transpired within the past year anything *new* with reference to the best mode of *extracting teeth*, a more effectual method of treating cases of *salivary calculus*, nor a surer method of disposing of *alveolar abscesses*. To extract an abscessed tooth, and then replace it, for the purpose of removing the difficulty, is objectionable practice, and should, in my opinion, be abandoned.

[The majority of the section would respectfully dissent from the statement that all roots of the anterior teeth should be filled with gold, believing, as they do, that other materials may be used for the purpose more easily and with equal success.

Also, they would state that they regard the replantation of teeth, for the cure of alveolar abscess, as good practice in certain extreme cases.]

REPORT ON OPERATIVE DENTISTRY.

By GEO. B. McDONALD, Member of Section Four.

PROPER MANAGEMENT OF PROXIMATE, CUTTING AND GRINDING SURFACES OF THE TEETH.

IN consideration of failures in our attempts to stay the ravages of caries in the proximate surfaces of the human teeth, I have decided to devote this paper to the showing of the causes of failures, with a view of refilling cavities on such principles as to guard the fillings from failure in the future. As the cutting and grinding surfaces of the teeth are often involved with the proximate ones, I deem it proper to include them in the few remarks I shall make upon this subject.

It will be sufficient for my present purpose to describe the proper preparation and filling of the proximate surfaces of a right-upper central incisor and right-superior first bicuspid, where the cutting surface of one and the masticating surface of the other are involved, they having been previously filled and now requiring to be refilled. Before giving a description of such an operation as should be performed upon the central incisor referred to, let us first ascertain the cause or causes of the failure of the fillings previously introduced. If we succeed in finding this we shall undoubtedly be able to see our way clear to successfully fill this tooth, so that the operation cannot fail again. After a careful examination of the tooth in question we arrive at the following conclusions: *First.* We did not have room enough, laterally, to fill the tooth properly, as we wedged the same day we filled it, when we should have pressed it and the adjoining tooth apart for one

week or more, as circumstances might indicate. *Second.* We did not properly anchor our filling in the cervical, palatal and labial walls of the tooth. *Third.* We did not bevel the margins of the cavity thoroughly, especially at the cervical margins, leaving a frail and partially disintegrated structure which continued to disintegrate after the fillings were inserted. *Fourth.* We packed our gold at the cutting edge in enamel, which shows that there were checks in the cutting edge of the tooth, and these checks caused the cutting edge to split off when exposed to the forces used in biting hard substances. *Fifth.* We discover that too large pieces of gold were used, and not perfectly impacted. Only one hour was spent on them with an automatic or hand mallet, when, to make a perfect operation, we should have spent a much longer time, even with the use of the electro magnetic mallet, in impacting small pieces of gold foil into the cavity. *Sixth.* The gold was not finished down perfectly even, especially at the cervical margin, thereby allowing lodgments of destructive agents along the margin of the filling which caused disintegration of the enamel. These are six good and satisfactory reasons why our fillings failed, any one of which was sufficient.

With the knowledge gained in ascertaining why we failed, we will proceed to refill this tooth, with the intention of preserving it for twenty years or more. Having wedged it apart from the adjoining teeth from one-sixteenth to one-eighth of an inch, and having kept it in this position one week or longer, or until all soreness that has been induced in the peridental membrane by the wedging shall have subsided, we now apply the rubber dam; and, taking a proper shaped corrundum wheel, cut away that portion of the cutting edge of the tooth yet remaining between the cavity in the mesial and the one in the distal proximate surface more or less, as the case may require. Now, with proper shaped stone-cut engine burrs, we make retaining grooves through the cutting edge of the tooth, extending them to cervical, palatine and labial walls. With bud-shaped enamel burrs we bevel or properly shape the entire orifice of the now compound cavity, removing every particle of disintegrated tissue, and with a strip of No. o emery cloth polish off the external margins. With the hot-air syringe we blow out the chips that may be in the cavity and pronounce it ready for the gold. Now take one sheet of cohesive gold foil (No. 4), fold it

four times with a nickel-plated spatula, and with a pair of foil shears cut into strips one-sixteenth and one-eighth inches wide; take a strip of the narrow gold, anneal it slightly, and with a properly-pointed hand instrument anchor it in starting points made along the cervical wall of the cavity. Now with the electro magnetic mallet we proceed slowly, surely and perfectly to pack these small pieces of gold foil against the walls until we have restored the tooth to its original contour with solid gold, perfectly uniform in density from center to circumference, which will stand the force of incising food like cast steel, and cannot possibly be dislodged from its position without the breaking of the tooth at or near the neck. We now finish this filling with properly shaped separating saws, files and strips of emery cloth till it is ready to polish. The polishing is effected by the use of strips of crocus cloth and whiting on linen tape, with the assistance of the dental engine, flexible rubber cones and wheels.

On an examination of the right-upper bicuspid, which has previously been filled on its mesial and distal proximate surfaces, we find the filling partially out and the structure extensively decayed around the fillings, which would fall out were it not for the adjoining teeth. We find all the causes of failure that were present in the case of the incisor with two additional ones, namely: We left an organic fissure on the grinding surface of the tooth, which should have been opened into with a small, thin corrundum wheel and the two proximate cavities connected. We also find, upon an examination of the gold, that we had used too large pieces in filling, as cylinders, pellets and ropes of gold foil twisted up with our fingers. On taking the filling apart the gold separated easily, and each filling is made up of different large pieces of gold pressed loosely against each other, there being no cohesion of the gold—the condition that must exist in order to get the best results.

After wedging this tooth the same as the incisor, we apply the rubber dam and proceed to prepare for filling. When nearly ready we have a compound cavity presented, extending from the cervical wall of the mesial surface through the fissure to the cervical margin of the distal surface. We find that the walls of the tooth left standing are partially separated from each other, and that they are so attenuated that if left standing they will be likely to break off. We are more certain that this might occur when we

notice that each cusp is quite long, its antagonist having long cusps also. Our past experience has taught us, with this condition of things one or both of the cusps may be split off by the occlusion of the inferior teeth; so we cut off the cusps, using corrundum wheels of suitable form. After removing all the decayed portion we make starting points in the cervical walls and anchoring grooves along the palatine and buccal walls with a small stone-cut burr, having previously finished the entire margin of the cavity with a fine, sharp, bud-shaped burr, being sure not to leave a particle of disintegrated enamel at the orifice, where the gold and tooth tissue will be in contact and exposed to destructive agents. We proceed to fill, as before, by packing narrow, thin strips of gold into the starting points with a proper-shaped hand plugger, completing the operation with the electro-magnetic mallet, being sure to condense each piece thoroughly against the enamel and throughout the entire filling until we have restored the contour of the tooth, thereby making a gold crown with such gold cusps as can no more be split by the occlusion of the inferior teeth than could a crown of steel. Having finished this operation as we did the incisor, it is absolutely necessary that the adjoining teeth should knuckle up to the gold one, so as to come into perfect contact, to prevent food from getting between the teeth thereby irritating the gums, as is so often the case where V-shaped separations are made between them. If we have spent several hours on these operations, and have charged thirty or fifty dollars each for them, it will be infinitely better and cheaper for the patient than any other method.

I will here give a simple illustration of the principles involved in the method of operating which I have just given. If a barrel were hooped with common twine it would be a very weak vessel, and the staves would separate when but little force was brought against them. When a barrel is hooped with iron the staves become a unit, as it were. Such a barrel can withstand tons of mechanical force without being broken. The ordinary method of filling frail and extensively decayed teeth with cylinders, pellets and ropes of gold foil twisted up with the fingers and packed with automatic or hand mallet is to be compared to the twine-hooped barrel, while the process I have heretofore described is to be compared to the barrel with the iron hoops. A tooth

restored according to the method I describe will stand any necessary force without being split apart, because the enamel is supported by a solid band or hoop of gold as strong as steel. There are those who argue against cutting away too much tooth-structure. I assert, without fear of successful contradiction, that there are ten failures for the want of cutting away enough frail tooth-structure, to be replaced with rolled gold, where there is one from too much cutting.

"Haste makes waste," is an old maxim, and in nothing can it be better illustrated than when performing operations on the natural teeth. Hasty work is usually very imperfect, while operations upon which sufficient time is spent are more likely to be successful. I will here say that the value of clinics, to illustrate at our meetings that which relates to operative dentistry, cannot be overestimated. Finally, I would say that if we practice in accordance with the principles herein stated our efforts will usually be crowned with success, and the teeth of our patients saved and restored to their former usefulness for many years.

VOLUNTEER PAPER ON OPERATIVE DENTISTRY.

By THOS. C. STELLWAGEN.

THE NATURAL DENTINE FOR CAPPING EXPOSED TEETH PULPS.

SOME time since I called the attention of the dental and medical professions to the use of the actual cautery, by means of a coal of fire made by igniting hickory pivot wood, such as is prepared for dentists by being seasoned and condensed by passing through steel draw-plates.*

It is recommended by its simplicity, inexpensiveness and efficiency. Use has proven it of value in treating superficial abnormal growths, hæmorrhage, sensitive dentine, etc.

* See "The American Journal of the Medical Sciences," No. CXLVI, New Series, April, 1877, page 561, Philadelphia, Henry C. Lea; and "Johnston's Dental Miscellany," page 155, Vol. 4, No. XL, April, 1877, New York, Johnston Brothers; and "Medical and Surgical Reporter," May 5, 1877, page 403, D. G. Brinton, M.D., Philadelphia.

To-day I ask you to consider the natural dentine for capping exposed teeth pulps.

It was during the examination of the last class but one that graduated from the Philadelphia Dental College that it occurred to me to seek for some more natural and simple means for the immediate covering of exposed dental pulp tissue.

The number of articles, already used for the purpose is so great, that the mere attempt to recall them requires considerable mental effort. I am about to add one more with the hope of shortening the list by having it universally adopted, to the exclusion of the others.

Medical science has demonstrated that where an ulceration of the skin has become chronic, the transplantation of small particles of epidermis from a healthy surface of the body, has the effect of assisting in the healing of the ulceration; the transplanted tissue cells acting as nucleuses about which the new first develop, as coral reefs in the ocean eventually become islands. A step further and we remember that small portions of bone or periosteum are often used in the same manner for producing centers of ossification, where bony tissue has been lost. They seem to resemble the points of ossification in the cartilaginous skeleton of the infant.

Attempts to assimilate the capping material to the dental substance have been made which are so ingenious and useful that it would seem to be a pity that they had not realized the hopes of their projectors. They serve, however, to show that all who study the operation wish to attain the greatest similarity of tissue.

Why not then use the tooth substance?

After removing the diseased structure, if the pulp is exposed allow the wounded surface to glaze over, and then, with a keen, sharp excavator, shave off from the walls of the cavity enough healthy dentine to cover over the point to be capped. After this is accomplished place a small metallic cap — platina I generally prefer—to which enough gutta-percha has been attached, by warming, to hold it in position, and proceed to fill, taking care not to displace this bridge, which is designed to protect from pressure and as an additional non-conductor of heat and electrical currents.

On no account wash or remove the powdered healthy dentine from the surface of the glazed pulp. Keep all other substances from coming in contact with this delicate tissue, whether they be

the so-called medicaments such as creosote, carbolic acid, chloride of zinc or even simple alcohol or water; they are foreign bodies and are apt to excite inflammation.

The operation as described has been most successful with me, and for about eighteen months I believe I have capped every exposed pulp this way. My successes embolden me to beg of you to accept my recommendation of it as worthy of trial.

VOLUNTEER PAPER ON OPERATIVE DENTISTRY.

By GEO. J. FRIEDRICHS.

EROSION OF THE TEETH AND ITS LOCAL TREATMENT.

I HAVE been greatly surprised to find, upon consulting the text-books of our profession, that so little attention has been devoted to so serious a disease as that which forms the subject of this paper. Hardly two pages in any one work on Dental Surgery, in the many that I have consulted, have been assigned to this subject. In my own practice (I do not know how it is with others), ten per cent of the persons consulting me for dental advice are suffering more or less from this disease, and the only remedy so far proposed, by the authorities who have written on this subject, is to wait until the disease has sufficiently progressed, so that the eroded part can be reamed out into a cavity and filled with metal, as one after another may threaten from its extent or depth.

This disease has been divided by writers into congenital and accidental. The former occurring previous to eruption, the latter at any subsequent period of life. I shall, however, confine my remarks in this paper to the accidental occurrence of this disease: this being a species of caries, characterized by gradual decomposition, first of the enamel, and afterward of the subjacent dentinal tissue of a tooth. Erosion, properly speaking, confines itself to the enamel, and it generally attacks a number of teeth at the same time, usually developing itself on their surfaces near the margin of the gums. The decomposed part of the enamel is white, and of a soft and chalky texture, generally very sensitive to thermal changes,

and to the touch. The teeth most liable to be affected by this disease are the superior incisors, cuspidati, and bicuspids, and singular to say, sometimes those only on one side of the mouth. The next most liable are the bicuspids and molars of the inferior maxilla. Occasionally the process begins at a number of points, and these, enlarging, finally coalesce, to the destruction not infrequently of all the anterior enamel wall.

CAUSES: I do not propose here to enter into my opinions, or to theorize on the probable cause or causes of dental erosion. I will, however, repeat the promulgated opinion of different writers, as to the causes to which this disease has been attributed, to wit, constitutional predisposition to viscidity of the fluids of the mouth, acrid secretion of the mucous membrane, utero-gestation, dyspepsia, altered condition of the system after anæmic and zymotic diseases, electro-chemical action. In the words of Dr. Garretson,* "The present conviction of the author is, that the true explanation is just now, for the first time, enunciated in the electro-chemical experiments made by Mr. Kencely Bridgman, and that in this direction will be found to lie not alone the cause, but the prophylaxis."

Prof. Harris † "is of the opinion that the loss of substance which characterizes the affection is produced by the action of acidulated buccal mucus."

Prof. Harris in the same work above quoted, in speaking of tartar, cites from other writers what is called by them green tartar, which I, however, shall class under the head of erosion, as his definition clearly defines this disease. For he says that "this consists of little more than a mere stain upon the teeth, and is usually confined to the labial surface of the upper incisors, cuspidati, and bicuspids. It is met with more frequently in children than in adults. It is exceedingly acrid, irritating the gums and decomposing the enamel of the teeth. This description of tartar, if it can be called tartar, is indicative of an irritable condition of the mucous membrane, and of viscidity of the fluids of the mouth."

Treatment.

We all know that the vital force is ever on the alert to combat the injury done through the destructive influences of disease.

* System of Oral Surgery, by E. Garretson, M.D., D.D.S. (page 505).
† Principles and Practice of Dental Surgery, Dr. Chapin. A. Harris (page 413).

We are also aware that a tooth attacked at a given point by irritating agencies will, step by step, break and give way before the irritant, unless it is counteracted by the efforts of nature or art, and in the words of Dr. Garretson, "not but what such repair is attempted, and indeed oftentimes successfully accomplished, as witnessed in tubular consolidation, where power sufficient exists to perfect the attempt, as seen in the process generally spoken of as vitrifaction, or eburnification, a mode of natural cure and resistance which no mechanical operation, however successfully performed, can equal." Now from the above premises it is self-evident, if we can bring assistance to the inherent vital force of a tooth, this disease — erosion of the enamel — can be cured. The agent to accomplish this is nitrate of silver,— for when applied to an eroded part of a tooth it puts forth its fiat and says: so far shalt thou go and no farther. The salt, when brought in contact with the organic matter of the teeth, is decomposed; the oxide of silver is deposited,— an insoluble and inert substance — which protects and relieves these portions of the teeth of their hyper-sensitiveness, antagonizes the action of the morbific influences, and assists the "vis medicatrix naturæ" to eradicate the disease. The method of using it is, to chip off of a solid stick of nitrate of silver a piece about the size of a pin's head, applying this to the eroded part of the tooth, moving it over the surface until dissolved or decomposed, taking care to keep it from coming in contact with the gums as much as possible. If after a week's time the sensitiveness to the touch has not been allayed, the application must be renewed at intervals until this is attained.

No danger need be apprehended of its too frequent use, as no injury to the teeth can possibly ensue, for the escharotic operation of lunar caustic is always superficial, and it is almost impossible to make it act to a great depth. The salt produces, along with its excitant effect, contraction of the tissue, or, in other words, acts as an astringent, and this property also constitutes one of its therapeutic recommendations.

Dr. Whitney states that* "oft-repeated applications will usually prevent pain, and in most cases, if not arrest, at least greatly retard, the injury to the teeth from clasps or denudation."

You will find that after a few applications the surface of the

* Dental Register of the West, Vol. vii, No. 3, April, 1854. (page 206).

eroded part will be covered by a thin film of the oxide of silver, which must be allowed to remain until the subjacent layer of enamel becomes solid and structural consolidation has taken place, after which it can be scraped off, and the surface polished.

But in connection with this local treatment the constitutional must not be neglected, for if the system is in an asthenic or anæmic condition, that predisposes or induces this disease, proper remedies must be prescribed to bring the system back to a normal state of health. Dr. Garretson asserts, "whatever shall tend to so consolidate or protect the parietes of a cavity as to render the parts impervious and insusceptible to external agents, *will save the tooth.*" I cannot refrain from copying another paragraph from him, my object being to illustrate the principles that I have tried to demonstrate in this paper. "The study of the vitality of a tooth, and the study of its adverse influences, is the study of vitality and the expression of irritation anywhere. The treatment of dental caries is both medicinal and operative. That the teeth, in their formative state, partake of the healthy or unhealthy condition of the system at large, all observers admit. But here, unfortunately, the matter has been left, most practitioners acting on the premise that such impressions are never altered. At such a conclusion it is impossible not to express surprise.

"There is a constitutional treatment for the carious tooth, as there is for the carious maxilla, and from a common standpoint are diseases of both to be viewed. It is not, of course, every case of carious bone that demands systemic treatment; neither is it so with the teeth; the source of offense in the one, as in the other, may be strictly local in character; but ill success must ever attend that practitioner who has not the inclination to look for a primary lesion outside of things strictly local in signification." In conclusion, if the above premises are correct, when a tooth is protected the process of secondary calcification or eburnification takes place, where power sufficient exists to perfect the attempt. It then follows that those who teach the doctrine of the *New Departure* are more indebted to the oxides or other chemical combinations that are formed from an amalgam filling, when brought in contact with the parietes of the cavity of a tooth, than to any special preparation or combinations of metals. For I have yet to see the tooth filled with an amalgamated alloy that has been preserved for any length of time without it was discolored.

DISCUSSIONS.

Dr. HUNT: I think it is a mistake to say that erosion is created by acids in the secretions of the mouth. I premise what I am going to say by detailing an experiment that can be tried by any member. If a natural tooth is dropped into a diluted acid, that acid will attack the earth salts of the tooth and dissolve them out, leaving the animal tissue in the general shape of the tooth. If, on the contrary, a natural tooth is dropped into a solution of caustic potash, the potash will dissolve the animal tissue of the tooth, leaving the earth salts friable, so that they can be scraped away. I have for a long time been of the opinion that this erosion is caused by the action of alkali, and not of acids.

Dr. FRIEDRICHS: Will you please allow me to ask you one question? If it is affected by either alkali or acids, how is it that you sometimes find cases where it attacks only the teeth on one side of the mouth?

Dr. HUNT: I will come to that directly. The theory taught in the books is that the secretions in the mouth should be alkaline in their reaction, and not acid. It is a question in my mind whether there should be alkalinity or acidity, or whether there should not be a neutral condition of the oral secretions in the main. In a perfectly healthy person the forces are so balanced that there is not sufficient acidity or alkalinity to produce injury. In abnormal conditions these secretions are altered, so that you find in some mouths a strong acid, and in others a strong alkaline, reaction. I have found some mouths with so strong an alkaline reaction over the whole territory that red litmus paper has changed to a blue color almost instantly.

Dr. ATKINSON: Were they all smokers?

Dr. HUNT: I have found the discoloration spoken of in the mouths of females who did not smoke.

I have also found this state of things, and it is a singular one to me, that while the general condition of the fluids of the mouth was of an acid character, yet by taking a corner of the red litmus paper and putting it up under the free margin of the gum, I found an alkaline reaction. Now I come to answer Dr. Friedrichs' question. I would find alkaline reaction in some parts of the mouth, and under the free margin of the gum, and find it varying in degree in different parts of the mouth.

Dr. FRIEDRICHS: If there is any secretion that produces this disease it must be that from the mucous membrane. I think that it is one of the causes that can produce the effect, and account for the disease being met with sometimes on one side of the mouth and not on the other.

Dr. STELLWAGEN: This alkalinity of which you speak, do you consider it to be a secretion or excretion; or do you suppose that it may have been caused by the remains of some alkaline tooth-powder?

Dr. HUNT: I have found it (erosion) in the mouths of patients who did not use tooth-powder. All my observations have led me to the conclusion that this alkalinity is due to the abnormal condition of excretion of the gingival membrane. Finding a different degree of alkalinity in different localities, accounted to me for the fact that some teeth were attacked and some were not, and it also led me to believe that a portion of the margin of the gum could be in a pathological condition, and another portion, in a different part of the mouth, and even nearly contiguous, might be perfectly healthy. I have heard this erosion of teeth attributed to mechanical abrasion, produced by the use of a tooth-brush and powder, and the advocates of that doctrine have said: "You find that, while the teeth have been eroded rapidly at one period, that erosion has suddenly ceased, and there is no further progress of it." If these cases were investigated, they say it would be found that the patient had been using a harsh tooth-brush or a harsh powder at that period, and had ceased to use it; but I think it can be more reasonably accounted for on the ground that at the time this erosion was progressing, the organs excreting this alkali in abnormal quantities were in a pathological state. A change took place in the system when these excretions became normal, and then the trouble ceased.

I wish to mention a case which came under my observation a number of years ago.

A lady of over seventy years, who had taken peculiar care of her teeth, the tissues of whose mouth were in a healthy condition, had, on the labial surfaces near the gum of the lower central incisors, this erosion. It extended to the proximal surface of the teeth and then ran up in a groove nearly to the cutting edge. That groove was cut deep, and as smooth as if it had been pol-

ished. I have found a great many cases presenting this appearance. None of them gave any indications of agents at work such as we find in what we call the true decay of teeth. I think we cannot place too much stress upon the position that is taken in the paper of Dr. Friedrichs, and by the authors whom he quoted, that we should always diagnose our cases with a view to systemic treatment as well as local. I wish to state two cases in illustration.

A number of years ago a young patient, about fifteen years of age, the daughter of a physician, came to me with every indication of a rapid, general decay of the teeth. I immediately tested the secretions of the mouth and found there was a strong acid reaction. At my suggestion her father subjected her to a course of medical treatment, to correct the acid condition. In from three to six weeks this was almost entirely corrected, and I then filled the teeth, and they have not changed since that time, which was eleven years ago. She has had occasion to have but one additional filling placed in her teeth. Since that I have invariably, when I found this aggravated acid condition, sent my patients to physicians, who have in every instance corrected the evil. I had another case of two young girls who were twins, having apparently the same formation, structure and development of teeth. I filled quite a number of cavities, but not very large ones. After that they came to me again in two years for examination. I found that there was a state of general destruction of the teeth of one of them, but the character of the decay differed entirely from that which was produced by acids. I tested the secretions of the mouth and found them strongly alkaline, and I have always found that the appearances and symptoms attending the destruction of teeth by this alkaline agent to correspond in all particulars with those observed in the teeth of this girl of whom I speak. I wish to say that I would have presented a report as chairman of the section having charge of chemistry at this meeting, but I had it not sufficiently matured as a paper from a section should be.

Dr. Darby: I doubt not many of the members present have been in the habit of treating erosion of the teeth with nitrate of silver. Such has been my practice for years. It has, however, one serious objection, namely: that it discolors the teeth, and in the anterior part of the mouth this is a serious objection to its use. Nor is it always a sure remedy unless applied quite frequently.

Some two or three years ago my attention was directed to a new method of treating this disease by using the galvano cautery, as introduced by Dr. Oscar Solomons, a German who was associated with a friend of mine. It consisted, as most of you may be aware, of a strong battery, from which was passed a current of electricity through platina wires of various sizes. It was used for obtunding extreme sensitiveness in the dentine, and to my knowledge quite successfully so in a number of instances. The current of electricity was sufficiently strong to heat the platina points to a white heat, and these were brought in contact with the eroded surface of the tooth, or when excavating sensitive dentine the point was touched for a moment with the heated wires. The great objection to its general use is that it cannot be used in cavities difficult of access, because the platina points are made to touch each other, and of course the current is broken and the effect lost. When it can be used for erosion of the teeth, I should much prefer it to nitrate of silver, which cannot always be used without coming in contact with the soft tissues, and being a powerful escharotic it will destroy those tissues.

So far as I am aware, Dr. Stellwagen's method of capping tooth-pulps with scrapings of dentine is original with himself. I do not, however, see much in it that promises to be of value. If I were to cap pulps with tooth-structure I should get my material in a different way. I should prefer making shavings from a tooth which had been extracted. When we scrape dentine from a living tooth it becomes dead material, whether it has been removed two minutes or ten days.

Dr. STELLWAGEN: How do you know that?

Dr. DARBY: I am pretty sure that it is dead material. What *evidence* have you that it retains life after its connection with the living structure has been severed?

Dr. STELLWAGEN: The question is a very easy one to ask, but I could not answer, and doubt if any one can. We presume that transplanted skin or bone does not lose its vitality, so I say this death of the dentine, which my opponents assume takes place, remains to be proven; meanwhile the operation stands successfully.

Dr. DARBY: Of course we do not know the action upon the pulp. We all know that many pulps in many constitutions will bear an enormous amount of irritation without giving future

trouble. We know this from the irritating substances used in capping, but I should be very careful how I used scrapings of dentine for the purpose mentioned. If I understand Dr. Stellwagen, his practice is to put the scrapings of dentine in contact with the pulp and then cover them with some plastic material. His success is doubtless owing more to the capping which follows than to the benefit derived from his scrapings of dentine. Personally, I have had little trouble in capping pulps (recent exposures) with oxychloride of zinc. This (I know from frequent conversations with him in the past) has not been in keeping with his experience. I am prepared to say that I am successful in saving at least 90 per cent of all pulps capped, if the exposure has been a recent one, with no previous irritation. My practice is to first cover the exposure with oxide of zinc and creasote, made in a thick paste, and then add the oxychloride afterward.

I wish to say a few words upon the subject of the so-called new departure. I think it has received about as much public attention as it merits. Every practitioner at this time has made up his mind with reference to the principles set forth by the disciples of this new creed. I regret, however, that there are to be found many men who accept the creed and practice it upon the authority of others because it promises less labor and the same, or nearly the same, pay. Did I wish to make a lazy sloven of my fellow-practitioner I would preach to him the doctrine of the new departure. I would tell him that amalgam and gutta-percha, and the oxyphosphates and oxychlorides were better than gold; that when he had made beautiful fillings of gold (*which did not leak*) he had done the worst thing possible for his patient. The chief danger is not with the strong men in the profession, who are not moved by everything which appeals to ease and comfort, but with the men who joyously fall in line with that which makes dentistry easy work. In Philadelphia—I speak not for all Philadelphia dentists, but for many personal friends and acquaintances—we do not take very much stock in the so-called new departure. We look upon it as a slovenly method of practicing dentistry. I am firmly of the opinion that the man who publicly promulgates the doctrine of the new departure is doing more injury to the dental profession than he would do good if he lived to the age of Methuselah.

REPORT OF SECTION FIVE

ON

PHYSIOLOGY.

By M. S. DEAN, Chairman.

THE ORIGIN OF THOSE NESTS OF DENTICLES GENERALLY DENOMINATED "DENTIGEROUS CYSTS."

ALTHOUGH I have given considerable thought to this question, I do not claim that I have solved it with absolute certainty; but will give the conclusions to which I have arrived, and the histological and physiological facts upon which they are based.

In glancing over the literature upon this subject, I find the only histological account of these anomalies, of any value, is recorded in the Transactions of this Association for the year 1875. The mode of the *origin* of these abnormal productions, as there presented, is not, however, in accordance with well-established anatomical and physiological facts. And yet the theory was an ingenious one, and the suggestions it contained pointed very nearly in the right direction. The great initial error in the theory there advanced was in regarding the tooth-germ as a single cell, instead of an aggregation of cells. It was suggested in that report that a tooth-cell (or "mother-cell," as it was there termed) might, in an abnormally active condition, generate other tooth-cells; and from the latter these dwarfed teeth might originate.

I submit the following facts, as the foundation of the theory I am about to offer: 1, that the teeth are developed from two distinct histological elements; the enamel from the epithelium or *epiblastic* layer; the dentine from the dermis or *mesoblastic* layer; 2, that the enamel-organ becomes largely developed before the slightest trace of the dentine-papilla makes its appearance. Indeed, there are many facts that tend to establish quite conclu-

sively the theory that the development of the papilla is induced by and through the presence and influence of the *epithelial* body, constituting what is denominated the enamel-organ. Keeping these facts in view, let us look at a few histological facts, which are familiar to all embryologists who have examined the fœtal jaws during the later stages of intra-uterine life. Upon examining subjects, soon after the rupture of the epithelial cords is effected, (cords which up to this time had connected the dental follicles with the epithelial layer of the mucous membrane) large masses of epithelial cells will be found attached to their extremities; and sometimes detached aggregations of these cells are found scattered in various directions in the embryonal tissue.*

These epithelial proliferations vary greatly in quantity, and usually disappear before the teeth (from the cords of which they originated) are fully developed. I claim that under favoring conditions these epithelial masses may become enamel-organs, more or less imperfect, it is true; and that these enamel-organs may induce the development of corresponding dentine-papillæ; and also that these two organs may pass through all the successive phases of development that occur in the evolution of the normal dental organs. The magnitude of these abnormal teeth, and the perfectness of their structure, must depend upon the volume of the epithelial masses which constitute each individual enamel-organ, and upon the nutritive supply that may be furnished to them. It is not necessary for me to elaborate this idea further. I will, however, direct attention to a few facts which I think corroborate this view. We find, for instance, that the development of the teeth is not confined to their legitimate territory — the maxillæ; but that they may be produced in various and remote parts of the system: the bladder, the scrotum, the vagina, the eyebrows, etc., and in the ovaries, which are the favorite seat of these anomalous growths. These are well known facts; and these abnormal productions are admitted to result from the *epithelium* which has become invaginated in a fold of the mesoblastic layer; in other words, some epidermal cells have become invested within the dermal

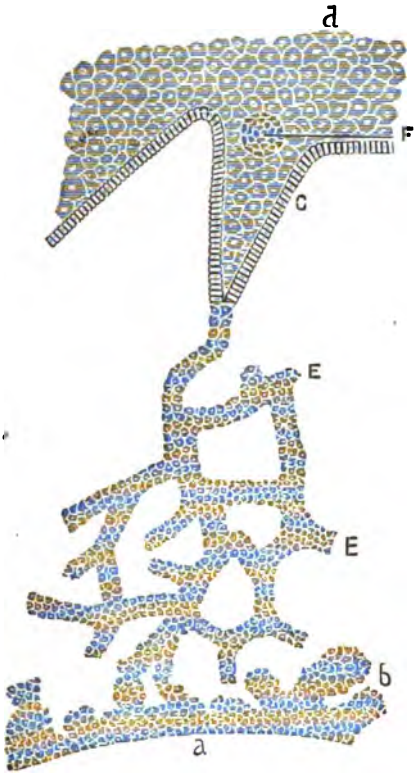
* These epithelial masses have been noticed by many histologists. By Serres they were believed to be *tartaric glands*. They have been observed by Magitot and Kölliker, but these writers have not assigned to them any physiological significance; Kollmann, however, claims that the enamel-organs of the supernumerary teeth are developed from an accumulation of these epithelial bodies.

tissue — circumstances which may more naturally occur in the tissues of the jaw than in the distant regions just referred to.

The histological facts alluded to in the above report are represented in the cuts here presented, which are taken from a treatise on the *Origin and Formation of the Dental Follicle*, by Drs. Legros and Magitot.

Fig. 41 represents a section taken from the jaw of an embryonal calf, magnified 260 diameters. The cut embraces the region external to the dental follicle (a) which latter is not shown in the figure.

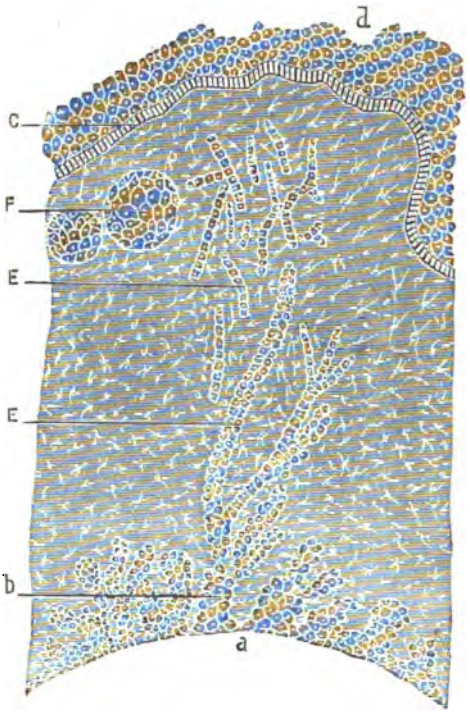
FIG. 41.



b, Epithelial buddings upon the follicular wall; c, columnar layer of the oral epithelium; d, oral epithelium; E, E, *débris* and buddings of the cord; F, epithelial globule in the epithelial *lamina*.

Fig. 42. Section taken from an embryonal calf, and embracing the same territory represented in fig. 41. Magnified 100 diameters.

FIG. 42.



a, Segment of the follicular wall; b, epithelial buddings upon the wall; c, columnar layer of the oral epithelium; d, oral epithelium; E, E, *débris* and buddings of the cord; F, epithelial globules from the débris of the epithelial lamina, which in the report are supposed to furnish the enamel-organs of the denticles found in dentigerous cysts.

DISCUSSION.

Dr. PEIRCE: I regret my inability at the present time to present to the Association a synopsis of the labors of the German histologists during the past year upon cell development, for I understand that much in that direction has been accomplished. I take great pleasure and intense satisfaction in bringing to the notice of the Association a work from the hands of the chairman of the section, Dr. M. S. Dean, on the "Dental Follicle," advance sheets of which I have had the honor of reading. It is a translation from the French authors, Drs. Legros and Magitot. I would warmly commend it to all of those who desire to become familiar with the origin of the tooth-germ and its subsequent development. It is especially adapted to the student by the familiar, conversational style in which the translator has presented it. It is, indeed, a book that every earnest seeker after truth concerning this complex portion of the human economy must possess.

PHYSIOLOGICAL OBSERVATIONS

ON THE

ACTION OF NITROUS OXIDE

($N_2 O_3$).

By JULIUS G. W. WERNER.

The three characteristic periods are:

1. Predominating inspiration.
2. Predominating and forcible expiration.
3. Gradual lessening and fainter-growing inspiration, till definite respiratory paralysis is established.

Its effects and phenomena:

1. Narcotism, presenting the phenomena of increased frequency of the heart's action (cardiac systole and diastole), with decreased frequency of respiration and loss of reflex action.
2. Asphyxia, presenting the phenomena of a feeling of a want of air (suffocation), with involuntary muscular contractions or convulsions, the convulsions being less violent than in ordinary asphyxiation caused by total deprivation of common air.
3. Anæsthesia. Complete anæsthesia is brought about by the combined influence of narcotism and asphyxiation.
4. The two periods of blood tension.
5. The danger of apoplexy.

I am sorry to say that I have been unable to summarize what I meant to, in written form, but I have tabulated on the blackboard a few heads on which I will speak briefly. Whatever there is in these remarks worthy of attention, or that will give practical information to the dentist, is to be attributed to Professor N. Zuntz, a German physiologist, as the result of thorough and extensive experiments in his laboratory.

Your attention is first called to the three characteristic periods; by that I mean the periods which would be very distinctly rec-

ognized by every one who administers nitrous oxide. The first is that of predominating inspiration; the second of predominating and forcible expiration, and the third, of the gradual lessening inspiration until a definite respiratory paralysis is established. In other words, when we administer nitrous oxide, it will be observed that the individual starts with taking the gas very freely; he wants a great deal of it in the first few inspirations, and unless he gets it he at once feels asphyxiated. In the second stage the very opposite of this will be observed. He will blow all the air out of his lungs that he can, and will not seem nearly as anxious to get more in. If we carry him still further, we bring him to a condition in which he will take but very faint, quick inspirations—gasps—until he will hardly inspire at all.

Under the head of its effects and their phenomena, we notice: *First.* That nitrous oxide narcotizes—by that we mean, it causes increased frequency of the heart's action and decreased frequency of respiration, which makes narcotism. Nitrous oxide has, when inhaled with sufficient common air, or oxygen, this narcotic principle. This shows itself in all animals that suckle their young, by a lessening of the tonic excitability of the vagus nerve which supplies the heart, and a decided decrease of the frequency of respiration,— which means that the inhibitory centers of respiration are narcotized to such a degree that the neural current, from without to within, and from within to without, is interfered with in its regular molecular propagation.

In breathing pure nitrous oxide, the frequency of the heart's contraction and dilatation increases from the beginning, but the frequency of respiration does not decrease so much as when an indifferential gas is inhaled. It seems to be the general understanding that nitrous oxide is not a differential gas, but I think upon that point that everything is not as yet known. As I understand Dr. Atkinson is on the opposite side, he will perhaps give some explanation of this subject. I understand that he thinks the oxygen is utilized to some extent—in other words, that it is taken up. The gentleman who made the experiments of which I am speaking is not conclusive upon that point, from the fact that it is very difficult to analyze the exhalations, as well (as he claims) as to keep nitrous oxide pure, it being very difficult to get an apparatus from which perfectly pure nitrous oxide can be administered.

We observe: *Second.* That asphyxiation is produced by nitrous oxide. It has been generally considered by the dental profession, almost up to the present day, that nitrous oxide has no other effect, when inhaled by the human being, than that of asphyxiation. That this is not so, is clearly shown by experiments upon animals; for when they are placed in pure nitrous oxide they lose the power of reflex action in a few minutes, while when placed in pure nitrogen they lose this power only after many hours—and some animals lose it only very little. In this asphyxiated condition we notice that the convulsions and the distress for want of air are less when nitrous oxide is inhaled than in ordinary asphyxiation. In the latter we have extensive convulsions, the subject struggling violently, while the muscles contract forcibly. These conditions are much less marked from the inhalation of nitrous oxide, and in some cases are extremely slight. We can then have narcotism and asphyxiation without much convulsion, though if we closely observe, there will always be convulsions of some muscles, principally those of respiration. Thus far we have established narcotism, and also asphyxiation.

We shall next observe that complete anæsthesia is brought about by this combination of narcotism and asphyxiation. We do not have narcotism alone, nor asphyxiation alone, but we have a thorough combination of these two conditions. Under the fourth head we will notice the two periods of increased blood tension. That there are two periods of increased blood tension should be known to every one who administers nitrous oxide. Here we reach the practical point, and that is whether nitrous oxide *ever* becomes dangerous, and *when* does it become dangerous. The increase of blood tension, so far as appears, presents itself in a two-fold manner, the first being noticed during the asphyxiating period; the second on recovery of the subject; and this secondary increase of blood tension is often, yes, almost always, the one that reaches the highest point, and may, therefore, become dangerous. The whole vascular system is governed by the vaso-motor nerves, which are a very peculiar system of nerves. When we pinch a vaso-motor nerve, or break it, or disturb it in any way from its normal physiological condition there is at once a decidedly perceptive result noticed on the vascular system which supplies those parts. There are oftentimes more than two decided effects following each other.

First there will be a manifest contraction, and then there will be a varying dilatation.

The fifth point is the danger from apoplexy. This is the last and perhaps the principal point I wish to bring out, one which touches every one of us who administers nitrous oxide, and that is, the danger in either one of these periods of increased blood tension, the period of recovery (the one when the individual is coming to himself) being the more dangerous. The injury is often so great that there is a predisposition brought about in certain vessels to dilate very freely, and from the effects of which the patient may never entirely recover. We all have heard of people who have taken nitrous oxide who have said, and say now, that they have never felt exactly as they did before they took it. Undoubtedly such cases are attributable to the fact that they have been narcotized by the gas to such an extent as to have brought about a very free dilatation of the blood-vessels of the brain and heart. This tendency for dilatation may not diminish for many weeks, months, years, or perhaps never. It is easily excited by fear or other emotions, so that in any system in which there is a predisposition to apoplexy, or of the blood-vessels to easily and extensively stretch out and dilate, nitrous oxide would seem likely to be decidedly prejudicial. Notwithstanding, we must still come to the conclusion that nitrous oxide is, comparatively speaking, a safe anæsthetic. People who more generally take nitrous oxide are fortunately not the kind who inherit a predisposition to apoplexy. They are mostly a class of people who care little for their teeth, who are not always mentally cultured nor mentally overworked, and in such people there is little danger. You can carry them off pretty far, while if you have a man who is easily excited, or who is a brain-worker, you can easily carry him to a stage where it is very dangerous, and where you would do him everlasting injury. I had this matter illustrated once in my own practice in a very forcible manner, which I shall never forget; and from that time I have given much attention to the study of this subject.

A young man presented himself for extraction of a left inferior third molar, which had been in a very painful condition for a number of months. I had advised him that in the long run it would be best to take the tooth out, but he delayed it for some time—till

he had been working hard at book-keeping and had been kept up late at night writing and studying—when one morning he presented himself in a very hurried and excited condition, suffering intense pain, and determined to have the tooth out immediately. I administered nitrous oxide gas, sending him thoroughly off beyond the second stage, where he was thoroughly narcotized as well as asphyxiated. The tooth was removed before he became conscious. When he came to again, and while he was yet resting in the chair, he very suddenly jumped up, and I grasped him. He put his head between his knees and hands and said, "O God! how my head aches; it is going to split!" I was a little alarmed and told him to lie back, and applied cold water. Upon feeling his pulse it was very forcibly impressed upon my mind that in this case there was an intense secondary blood tension. It proved to be so great that he did not recover his senses perfectly for more than half an hour. I applied ice to his head and gave him in the neighborhood of 20 or 30 grains of bromide of potash. In about half an hour he left the office. He went to his business, and finding he was unable to work went home and sent back word that he felt very restless, and wanted me to send some more of that medicine, as he thought it helped him. I sent him two large doses of bromide of potash and two doses of sulphate of morphia, giving him instructions to take the bromide of potash at half-hour intervals, and if he was not asleep after taking that to take one dose of sulphate of morphia, and twenty minutes after that the second dose. He went to sleep without the morphia and was all right the next day.

DISCUSSIONS.

Dr. Osmond: I have had a great deal of experience in administering nitrous oxide, and of late years I have come to the conclusion to withhold it in a great many cases where formerly I would have administered it without any fear. I have known of many who suffered from chronic headaches, from paralytic symptoms, from aberration of mind, and even of some parties who have been taken to the lunatic asylum from the reckless use of the gas. One case of the latter class I was fully conversant with — a lady who has now been nine years in the lunatic asylum at Longview, Cincinnati, Ohio, sent there by nitrous oxide, administered at the

Colton Dental Association. I wish to suggest a few very simple rules. There is a time, and you will all understand me, when nitrous oxide must not be given to females under any circumstances. One week before that time they should not take it. Three or four days after that period has passed it may be given, provided all other things are right. In the change of life it should not be given. Now for the cause of these things. In cases where females are affected in this way, it is owing to the condition of the blood-vessels of the uterus, and to the reflex action consequent, which causes a condition of the brain which is most unfavorably influenced by the administration of nitrous oxide. Again, during the hot summer weather, when people are liable to sunstroke, I make it a practice not to use nitrous oxide. Usually the blood is in such a condition from the long continued heat as to render it unsafe. It is not the death of the patient in the chair that we have to dread, but the after troubles, which may embitter the whole life.

Dr. PEIRCE: I wish to commend Dr. Werner's remarks because of the lesson of caution they teach us. I have patients who have suffered, and still suffer, from the effects of nitrous oxide. (The speaker briefly sketched several cases of serious illness coming under his observation, directly traceable to it.) One of these, a physician, lost forty pounds in weight, and was a constant sufferer from diabetes; another never knew a well day from the time he took the gas, and, after suffering a year and a half from diabetes, died; several ladies within my knowledge did not recover from its effects in six or eight months.

Dr. ATKINSON: If I felt disposed to self-glorification, I should be very happy to-night. Years ago I told you this very same thing; the mere mass generalizations are so pronounced that no one could see what the trouble was. Dr. Werner has really taken hold of this in a scientific manner, although handicapped by the wretched phraseology that pertains to the brochure that he has given us a synopsis of. Blood tension has been spoken of. How many men in this room understand what the blood tension is, and how it is produced, and how it is controlled? Probably the anæsthetic that is considered the most dangerous is the safest one known in the whole field of anæsthetics — I refer to chloroform. There is no such thing as the *physiological* action of *nitrous oxide*

on the human body. If it is *physiological*, it comports with health. If it is *pathological*, in the name of veracity, say so. There is not a tooth in the most tender mouth in the world that the operator cannot remove without any anæsthetic but the love of God beaming in his own eyes toward his patient, for his good, and not for the dirty dollar. Who has understood what respiration is? The author of this work has not pursued the subject down to its minutia, and asked himself how it is that oxygen operates upon the blood by the mutations of molecular affinities, and why it is that 96 per cent of the inhaled oxygen that has been in the lungs by inhalation becomes deprived of the power to support respiration in its bonds of affinity being put asleep, so as to be unable to unite with the blood through the walls of the air-vesicles and blood-vessels into the blood circulating in capillaries around the air-vesicles and thereby be introduced into the circulation, so that it can enter into combination and construct the protoplasmic elements of the tissues, so that nutritive activity and nourishment in general may go on properly. What becomes of that killed oxygen; and how is it that when it is once thrown out of the lungs that it still remains effete?

There is no known means yet revealed whereby we can awaken the narcotized bonds of affinity in the oxygen which has once been in the grasp of the lungs, except by passing it through the vegetable kingdom, and then it is fit for animal respiration. These are the questions we must inquire into before we are able to understand how it is that the vaso-motor system is influenced by the oxygen that has been received into the blood-circulation, to hang on loosely by an oxygenating process, a sort of quasi-oxidation of periphery of the red blood corpuscle, whereby the oxygen molecules hang, like so many bees in a swarm, to each other, until there is some demand in needy territory, that they may receive an invitation of the affinities of the molecular mass, and thus enter into combination and construct tissual elements and have them in that state of tonicity that will prevent this immense "blood tension" that gives us the dilatations of the capillaries that is presented in such cases as *sunstroke*, where there is an undue amount of pressure in the atmosphere! How many men in going deep in mines have suffered from this tension? They often come out with a blood tension that they never recover from!

How is it that these men who have no idea of what they are doing, administer nitrous oxide? It is because these questions have not been examined. It is because they are unable to distinguish the difference between anæsthesia and apoplexy, and know not why it is that when we have free oxygen in connection with anæsthetics in the lungs, that a patient is safer than he was before. And then we must understand that a great many chemical questions are not yet settled. Why should we jump at conclusions and rush in like "fools where angels fear to tread," and administer these anæsthetics for the sake of getting filthy lucre, the use of which will draw us down into darkness?

Dr. WERNER: I thank Dr. Atkinson for explaining more fully what I termed narcotism. I think I agree with him as far as I did go; what I meant by narcotism was simply lessening or lowering the tonic excitability of the neural current. I think he will agree with me that death from anæsthesia, produced by nitrous oxide, is brought about in this way; further, that the store of oxygen holding tissues is reduced, and the blood corpuscles not being fed with oxygen, rush when the pure air comes into the lungs with an immense affinity for this oxygen that they could not make use of before, and thereby produce an effect on the vaso-motor nerves which causes such an intense secondary blood tension. Blood tension is a profound study, and no one that has never studied the subject knows what is really meant by blood tension. While I am generally opposed to anæsthesia being produced so freely by so large a number of incompetent men, still if a man who is well posted observes the three distinct periods which Professor Zuntz explains, and learns from his writings that at the second period anæsthesia begins and is already sufficient to last for any short dental operation, the mistake made in the case that I have cited in my own practice, and similar mistakes, may be avoided. I am quite sure that in the particular case that I cited if I had not carried the person off so far, which was done in order to have more time to perform the difficult extraction, but had stopped at the second period, the individual would have escaped with much less injury. I do not think I agree with Dr. Atkinson — and perhaps it is because I do not understand the subject as well as he does—in regard to chloroform, for I must consider chloroform as abominable and dangerous an agent as has ever been used in the healing

art, certainly for the dentist. I will tell you my reason for it. There are not so many people, in proportion, who die from taking chloroform for amputations as die from the simple operation of tooth extraction.

The only explanation which we have is that in fatal cases from extraction under chloroform administration the fatal moment is brought about when the nerves of the tooth are separated from the main branch, when we sever the tooth-pulp or its nerves, or those of the periosteum from the main trunk of the nerve. It is then that a reaction of reflex kind travels along the trunk of the trigemini whose posterior or motor root is closely connected with the vagus, the nerve supplying the heart, and a shock to the latter nerve under chloroform narcosis when the nerves are all in a depressed condition is a most dangerous thing, and it is likely that the shock under these conditions is what makes extraction under chloroform so dangerous.

Dr. BARRETT: If we are to make this Association more useful than it hitherto has been, to have the work more perfectly done, it must first be thoroughly digested in the sections. The fifth section has sustained a great calamity in the loss of Dr. McQuillen, who was to have prepared a report on Physiology. I hope another year we shall have recovered from this stunning blow, and that a thorough report will be prepared. I have in my mind, if some present expectations are realized, the plan of performing some physiological experiments before the section, and it seems to me such demonstrations might be made extremely useful.

TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION

AT THE

TWENTIETH ANNUAL SESSION,

HELD AT BOSTON,

Commencing on the 3d of August, 1880.

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CONTENTS.

	PAGE
Disclaimer	2
Officers for 1879–80; 1880–81	6
Roll-call	7–11
Adoption of Executive Committee's Programme	11
Invitation from dentists and dental-goods dealers to a drive	11
Invitation from the city authorities to an excursion	11
Report of Publication Committee	11
Report of Treasurer	12
Action on amendments to Constitution	12, 13
Motion of Dr. Buckingham to amend verbally	13
Report of Committee on Credentials	13
Action on the letter of Dr. Birge	14
Action on Section 2 of Article III. of Constitution	15
Resignation of Dr. R. Finley Hunt	15
Report of Committee on Consolidation of Societies	15
Extending courtesies of the floor to Dr. Field, of London	16
Report of Committee on Directory	16
Resolutions regarding published endorsements of materials, etc.	18
Motion inviting Dr. Tucker to address the Association	19
Auditing report of Publication Committee	19
Auditing report of Treasurer	20
Appointment of a committee to draft resolutions on the death of S. S. White	20
Vote of thanks to the dentists and dealers in dental goods of Boston	20
Presentation of instruments by Dr. Talbot	20
Change time of electing officers	21
Invitation from the Secretary of the Art Museum	21
Appointment of a memorial committee on the death of Dr. H. L. Sage	21
Appointment of a committee on International Congress	21
Resolution instructing the Publication Committee	21
Motion to discontinue the payment of salaries to Treasurer and Secretary.	21
Action on resolution instructing Publication Committee	22
Adoption of resolution recommended by the Section on Education	22
Reorganization of Sections	23
Selection of next place of meeting	24
Election of officers	24
Resolution instructing Treasurer to pay bills	24

PAGE
Resolution of thanks to Local Committee, reporters, and others . . . 24
Resolution of thanks to City of Boston 24
Resolution of thanks to retiring officers 24
Resolution of thanks to Institute of Technology 24
Resolution of thanks to the retiring President 25
Resolution of thanks to officers of the Art Museum 25
Committee on International Congress 25
Report of Committee on death of Dr. Sage 25
Report of Committee on death of S. S. White 25
Installation of officers 25
Local Committee, appointment of 25
Publication Committee, appointment of 25
Notices of amendments to Constitution 26
Memorial pages 27, 28, 29

REPORTS AND VOLUNTEER PAPERS.

Section I.

Report by C. S. Stockton, Chairman 163
Volunteer Essay on Dental Art, by Eben M. Flagg 164

Section II.

Report on Education, by J. N. Crouse, Chairman 139
Supplemental Report on Education, by T. W. Brophy 141
Supplemental Report on Education, by L. C. Ingersoll 142

Section III.

Report on Nomenclature and Terminology, by W. H. Atkinson, Chairman. 133

Section IV.

Report on Operative Dentistry, by E. T. Darby, Chairman *pro tem.* . . 56
Volunteer Essay, "Oral Electricity and the New Departure," by John J. R. Patrick 57

Section V.

Report on Anæsthesia, by W. C. Barrett 100

Section VI.

Report on Cases of Diseased Antrum, by W. N. Morrison 81
Report on Certain Therapeutic Agents, by C. A. Brackett 82
Report, "Taking Cold" and Hyperæmia, by F. M. Odell, Chairman . . 42

VOLUNTEER PAPERS.

Essay on the Unwritten Law of Dental Ethics, by C. A. Marvin . . 125

DISCUSSIONS.

Therapeutics—discussed by
Dr. Meriam 49
Dr. Andrews 49

PAGE

Pathology—discussed by
Dr. Morgan 50
Dr. Werner 51, 53
Dr. Atkinson 52, 53
Dr. Mills 54
Operative Dentistry—discussed by
Dr. Tucker 70
Dr. Atkinson 72, 74, 75, 87, 88
Dr. Buckingham 73, 75
Dr. Allport 74, 75, 78, 79, 80, 81, 92
Dr. Morgan 78, 79, 80, 88
Dr. Barker 79
Dr. Dickerman 79
Dr. Fillebrown 81, 82
Dr. Thomas 81, 82, 86, 87
Dr. Taft 84, 86
Dr. Goddard 84
Dr. Friedrichs 89
Dr. Lord 90
Dr. Stockton 90
Dr. Cook 92
Dr. Webb 93
Dr. Wetherbee 94
Dr. Mills 96
Dr. Niles 97
Dr. Waters 98
Dr. Wilson 99
Anæsthesia—discussed by
Dr. Werner 115, 120, 123
Dr. Atkinson 116, 117, 120
Dr. Barrett 117, 119, 120, 121, 122, 123
Dr. Shumway 118
The President 120
A member 120
Dr. Brophy 121
Dr. Wilson 122
Dr. Buckingham 122
Dental Education—discussed by
Dr. Allport 148
Dr. Morgan 151
Dr. Buckingham 152
Dr. Stockton 154
Dr. Moore 155
Dr. Templeton 156
Dr. Barrett 158
Dr. Wetherbee 161

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* These go out August, 1881.

MINUTES OF TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION.

SESSION OF 1880.

BY GEO. H. CUSHING.

FIRST DAY—MORNING SESSION.

THE AMERICAN DENTAL ASSOCIATION commenced its Twentieth Annual Session at Huntington Hall (Massachusetts Institute of Technology), Boston, Tuesday, August 3, 1880, at 11 o'clock A.M., the President, L. D. Shepard, in the chair.

The session was opened with prayer by the Rev. Dr. Studley.

The roll of qualified members was then called, and the following were found either to be present or to have forwarded their dues:

ALLPORT, W. W.	208 Wabash ave., Chicago.
ALLAN, CHAS. F.	Newburg, N. Y.
ATKINSON, W. H.	41 East Ninth st., New York.
ANDREWS, ROBERT R.	Cambridge, Mass.
* ALLEN, JOHN	314 Fifth ave., New York.
BAUER, JOSEPH	130 Esplanade st., New Orleans.
* BROWN, SENECA B.	Fort Wayne, Ind.
BUCKINGHAM, T. L.	1206 Vine st., Philadelphia.
BARRETT, W. C.	11 West Chippewa st., Buffalo, N. Y.
BROPHY, T. W.	125 State st., Chicago.
BRACKETT, C. A.	64 Touro st., Newport, R. I.
BECK, C. S.	Wilkesbarre, Penn.
BAKER, H. A.	99 Boylston st., Boston.
BROWNE, R. W.	New London, Conn.
BOGUE, E. A.	29 East Twentieth st., New York.
BARKER, WM.	283 Westminster st., Providence, R. I.

Those marked thus (*) were absent but sent their dues.

Buckland, A. W.	Woonsocket, R. I.
Buckland, L. L.	146 Westminster st., Providence, R. I.
Bronson, W. A.	8 East Thirty-fourth st., New York.
Bishop, H. F.	Worcester, Mass.
Barfield, S. B.	90 Mulberry st., Macon, Ga.
Blake, J. E.	Amesbury, Mass.
Bullock, Charles	Cambridgeport, Mass.
Brockway, A. H.	13 Greene ave., Brooklyn, N. Y.
Batchelder, J. H.	Salem, Mass.
Bonwill, W. G. A.	1719 Locust st., Philadelphia.
* Colton, A.	Hudson, N. Y.
Crouse, J. N.	734 Michigan ave., Chicago.
* Chaim, M. L.	30 Cooper Institute, New York.
Cushing, Geo. H.	34 Monroe st., Chicago.
Cook, Chas. D.	133 Pacific st., Brooklyn, N. Y.
Curtis, J. W.	Brunswick, Me.
Clement, C. W.	939 Elm st., Manchester, N. H.
Church, W. P.	260 Westminster st., Providence, R. I.
* Cowie, Henry	Detroit, Mich.
* Cleland, Jas.	Detroit, Mich.
Clapp, D. M.	196 Boylston st., Boston.
Codman, J. T.	347 Columbus ave., Boston.
Chandler, Thos. H.	Boston.
Clark, C. S.	Main st., Brattleboro, Vt.
Colgrove, W. H.	Johnstown, N. Y.
Coyle, J. H.	Jackson st., Thomasville, Ga.
Cook, J. O.	Waterbury, Conn.
Carroll, C. C.	Meadville, Penn.
Coburn, H. W.	Lowell, Mass.
* Dennis, S. W.	33 Kearney st., San Francisco, Cal.
Dickerman, D. S.	Taunton, Mass.
Dean, M. S.	34 Monroe st., Chicago.
Darby, E. T.	1513 Walnut st., Philadelphia.
Davis, E. B.	Concord, N. H.
Dudley, A. M.	223 Essex st., Salem, Mass.
Davenport, J. N.	Northampton, Mass.
Davenport, Isaac B.	Williamstown, Mass.
Essig, C. J.	1533 Locust st., Philadelphia.
French, C. S.	Quincy, Mass.
Francis, Chas. E.	33 West Forty-seventh st., New York.
Fillebrown, Thos.	Portland, Me.
Fundenberg, W. H.	323 Penn ave., Pittsburg, Penn.
Friedrichs, Geo. J.	155 St. Charles st., New Orleans.
Finley, M. F.	Ypsilanti, Mich.
Filbert, P. K.	Pottsville, Penn.
Field, Geo. L.	Detroit, Mich.
Flagg, Eben M.	54 Bible House, New York.

* Freeman, S. A.	Buffalo, N. Y.
Goddard, Wm. H.	Louisville, Ky.
* Gaylord, E. S.	New Haven, Conn.
Grant, Geo. F.	86 Pinckney st., Boston.
Harlan, A. W.	70 Dearborn st., Chicago.
Hill, J. L.	Gettysburg, Penn.
* How, W. Storer	Cincinnati, Ohio.
Harrington, D. G.	Boston.
Honsinger, E.	318 Park ave., Chicago.
Harris, O. F.	Worcester, Mass.
Hurlbut, J. S.	Springfield, Mass.
* Hoysradt, G. W.	Ithaca, N. Y.
* Hurtt, J. M.	Peoria, Ill.
Hurlbut, C. S.	Springfield, Mass.
* Ingersoll, L. C.	Keokuk, Iowa.
Ingalls, D. B.	Clinton, Mass.
Jones, W. H.	Northampton, Mass.
Kidder, J. H.	Lawrence, Mass.
Knapp, W. B.	Fort Wayne, Ind.
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* Lathrop, Joseph	Detroit, Mich.
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Leavitt, W. P.	19 Tremont Row, Boston.
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* McNaughton, D. C.	Jersey City, N. J.
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Matteson, C. F.	3501 Cottage Grove ave., Chicago.
Marvin, C. A.	148 Clinton st., Brooklyn, N. Y
Moore, T. T.	Columbia, S. C.
Meriam, H. C.	257 Essex st., Salem, Mass
Morgan, W. H.	Nashville, Tenn.
Miller, Chas.	331 Madison ave., New York.
Marriner, J. Frank	Ottawa, Ill.
Northrop, A. L.	44 West Forty-sixth st., New York.
Niles, Ed. S.	146 Boylston st., Boston.
Osgood, Chas. H.	147 Tremont st., Boston.
Odell, F. M.	18 West Eleventh st., New York.
* Palmer, S. B.	39½ Warren st., Syracuse, N. Y.
Preble, M. B.	Auburn, Me.
Page, Edward	Charlestown District, Boston.
Page, W. E.	Charlestown District, Boston.

PRIEST, A. N.	Utica, N. Y.
PEIRCE, C. N.	1617 Green st., Philadelphia.
PERRY, S. G.	10 East Thirty-fourth st., New York.
POST, O. R.	Brattleboro', Vt.
RIDEOUT, LEON	Lynn, Mass.
ROBERTS, E. J.	75 State st., Augusta, Me.
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* REHWINKEL, F. H.	Chillicothe, Ohio.
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STODDARD, G. W.	Belfast, Me.
SMITH, H. A.	Cincinnati, Ohio.
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STOCKWELL, C. T.	327 Main st., Springfield, Mass.
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SALMON, IRA A.	Boston.
SHUMWAY, T. D.	Plymouth, Mass.
* SMITH, D. D.	1417 Walnut st., Philadelphia.
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TAYLOR, L. C.	57 Church st., Hartford, Conn.
TALBOT, E. S.	125 State st., Chicago.
TRUEMAN, WM. H.	900 Spruce st., Philadelphia.
TENNEY, A. W.	Stoneham, Mass.
WETHERBEE, I. J.	Boston.
WILSON, GEO. H.	Painesville, Ohio.
WATERS, GEO. F.	8 Beacon st., Boston.
WEBB, M. H.	Lancaster, Penn.
WERNER, J. G. W.	41 Upton st., Boston.
WHITTEN, DAN'L F.	South Boston.
WALKER, A. C.	Montgomery, Ala.
WATLING, J. A.	Ypsilanti, Mich.
WATKINS, S. C. G.	Montclair, N. J.
WILSON, C. P.	Boston.
YOUNG, G. A.	Concord, N. H.

The following sent their dues for the years set opposite their names:

C. A. KITCHEN, Rockford, Ill. 1879

EDMUND NOYES, Chicago	1879
W. E. MAGILL, Erie, Penn.	1878–79
D. E. KELLY, Ashtabula, Ohio	1879

The President then addressed the Association in a few appropriate remarks.

A verbal report was made by the Executive Committee, who presented the printed programme. This was adopted.

An invitation was extended to the Association, from the dentists and dental goods dealers of Boston, to a drive through the suburbs on Wednesday.

Also one from the Mayor and city authorities of Boston to an excursion by steamer down the bay on Thursday.

On motion of Dr. McKellops the invitations were accepted.

The Publication Committee submitted the following report, which was adopted:

The Publication Committee respectfully submit the following report:

They have published three hundred copies of the Transactions for 1879, which have been distributed to all active members whom the Treasurer's list designated as entitled to receive them; also to honorary members, to all the dental journals in the world, so far as known to the committee, and to various libraries.

There are on hand about one hundred and twenty-five copies.

The following is a statement of their account with the Association:

AMERICAN DENTAL ASSOCIATION TO THE PUBLICATION COMMITTEE.

Dr.

To publication of 300 copies of Transactions of 1879		$196 75
" Engraving and electrotype		8 00
" Postage, express charges, etc		30 10
		$234 85

Cr.

By cash from Treasurer	$271 00	
" " sale of Transactions	7 00	
		278 00
Balance due the Association		$43 15

The committee wish to state that the Transactions might have been ready for distribution in ninety days from the date of adjournment, had they felt at liberty to proceed at once with the work; but the treasury was empty, and it was not deemed justifiable to commence printing until enough money was collected to insure the payment of the bills. So soon as the proper amount was secured, they

proceeded with all the expedition possible, compatible with the proper execution of their task.

GEO. H. CUSHING, *Chairman.*

We have examined the above report and found it correct.

J. N. CROUSE, C. S. STOCKTON, } *Ex. Com.*

The Treasurer offered the following report, which was adopted:

WM. H. GODDARD, TREAS., IN ACCOUNT WITH AM. DENTAL ASSOCIATION.

1879.		*Dr.*	
August.	To balance	$31 21	
	" cash from assessment	208 00	
	" " dues	660 00	

Contra Cr.

August.	Paid voucher No. 1.—Programmes		$7 00
	" " 2.—Seal		8 00
	" " 3.—Ch'n Publication Com., 1878		146 66
	" " 4.—Salary Secretary		100 00
	" " 5.— " Treasurer		100 00
	" " 6.—Reporter		125 00
	" " 7.—Ch'n Com. of Arrangements		77 50
1880.	" " 8.—Stamps, Incidentals, etc		10 20
May,	" " 9.—Ch'n Publication Com., 1879		141 00
	Balance		83 85
		$899 21	$899 21

WM. H. GODDARD, *Treas.*

BOSTON, MASS., August 8, 1880.

BOSTON, MASS., August 8, 1880.

We have examined the above report and found the account correct.

J. N. CROUSE, C. S. STOCKTON, } *Auditing Committee.*

The following amendment to the constitution, offered last year, was then considered:

Under the head of "Instructions to the Publication Committee," insert, after the words "still on hand,"—

Any report or other paper to be entitled to publication in the volume of the Transactions for the year in which it shall be presented to the Association must be placed in the hands of the Publication Committee on or before the first day of September, and must also be so prepared that the proof-sheets furnished the authors shall be returned to the committee without material alteration or addition.

Every paper received by this Association and all plates or other means of illustration shall be considered the exclusive property of the Association, and shall be published for its exclusive benefit.

On motion of Dr. Buckingham, this was verbally amended by striking out the word "exclusive" before the word benefit.

As amended, it was then unanimously adopted.

The following amendments to the constitution, offered last year by Dr. Spaulding, were then adopted:

To amend third division of Section 6 of Article V. by striking out the words "Nominations and."

Also to amend the next paragraph of the same section so that it shall read as follows:

The President shall appoint two members of this Association, who shall act in conjunction with the Recording Secretary as the Publication Committee.

The following, offered last year by Dr. Beck, was then adopted:

To amend Section 2 of Article III. of the constitution by adding the words "or suspended" after the word "expelled."

The Committee on Credentials then made a partial report, which by subsequent reports was completed, as follows:

American Academy of Dental Science—S. F. Stearns, H. Eugene Smith, C. P. Wilson, F. N. Seabury.
Alabama Dental Association—A. C. Walker.
Boston Dental College—Isaac J. Wetherbee.
Brooklyn Dental Society—C. D. Cook, W. H. Atkinson.
Chicago Dental Society—A. W. Harlan, M. S. Dean, J. N. Crouse.
Connecticut Valley Dental Society—R. W. Browne, L. C. Taylor, W. H. Jones, C. S. Clark, C. T. Stockwell, J. S. Hurlbut, O. R. Post, J. O. Cook, J. N. Davenport, Isaac B. Davenport.
Dental Society of the State of New York—C. A. Marvin.
Dental Department of Vanderbilt University—William H. Morgan.
East Tennessee Dental Association—J. U. Lee.
First District Dental Society of New York—S. G. Perry, A. L. Northrop.
Fourth District Dental Society of New York—W. H. Colgrove.
Georgia State Dental Society—J. H. Coyle, S. B. Barfield.
Harvard Odontological Society of Boston—Daniel F. Whitten, Edward S. Niles.
Harvard Dental School—Thomas H. Chandler.
Illinois State Dental Society—George H. Cushing, J. Frank Marriner, C. F. Matteson, E. S. Talbot, T. W. Brophy, E. Honsinger.

Indiana State Dental Society—W. B. Knapp.
Kentucky State Dental Association—W. H. Goddard.
Lebanon Valley Dental Association—P. K. Filbert.
Massachusetts Dental Society—C. H. Osgood, Edward Page, George F. Grant, D. G. Harrington, J. M. Sherman, H. A. Baker, H. C. Meriam, E. G. Leach, I. A. Salmon, Dwight M. Clapp, O. F. Harris, J. T. Codman, Wm. P. Leavitt, O. Howe, H. F. Bishop, C. S. Hurlbut.
Maine Dental Society—M. B. Preble, G. W. Stoddard, J. W. Curtis, E. J. Roberts.
Merrimack Valley Dental Society—S. J. McDougall, C. W. Clement, D. B. Ingalls, S. G. Stevens, Leon Rideout, R. R. Andrews, G. A. Young, C. S. French, A. W. Tenney, T. D. Shumway, Charles Bullock, A. M. Dudley, H. W. Coburn, J. H. Kidder.
Missouri State Dental Association—H. J. McKellops, W. N. Morrison.
Mississippi Valley Association of Dental Surgeons—J. S. McCampbell.
New Jersey State Dental Society—C. S. Stockton, J. W. Scarborough, S. C. G. Watkins.
New Orleans Dental Association—Joseph Bauer, G. J. Friedrichs.
New York Odontological Society—Benjamin Lord, Charles Miller, A. H. Brockway.
New Hampshire Dental Society—E. B. Davis, J. E. Blake.
Northern Ohio Dental Association—George H. Wilson.
Odontological Society of Pennsylvania—W. G. A. Bonwill.
Pennsylvania State Dental Society—M. H. Webb, C. J. Essig, E. T. Darby.
Pennsylvania Association of Dental Surgeons—C. N. Peirce, W. H. Trueman.
Pittsburg Dental Association—W. H. Fundenberg, J. G. Templeton.
Rhode Island Dental Society—Wm. Barker, Wm. P. Church, A. W. Buckland, L. L. Buckland.
Second District Dental Society of New York—C. F. Allan.
Susquehanna Dental Association—C. S. Beck, G. W. Klump.

The Secretary read a letter from Dr. J. J. Birge, of San Francisco, in which he expressed a desire to be reinstated as a member of the Association upon paying the dues for the time elapsed since his resignation.

After due consideration, on motion of Dr. Bogue, seconded by Dr. Marvin, the Secretary was instructed to reply to the letter of Dr. Birge, and to express to him that while the Association gratefully appreciated his generous proposition, and were unanimous in their desire to comply with his wishes, they found it impossible to do so under the provisions of the constitution, but hoped he would again connect himself with the Association through the usual channel.

Dr. Fillebrown offered the following:

Voted, as the opinion of this Association, that unless a member of this Association has a vote of expulsion or suspension passed by his local society, the 2d Section of Article III. of the constitution does not apply to deprive him of membership in this body.

Dr. Morgan made a point of order that such a motion was out of order, as directly modifying a provision of the constitution.

The Chair ruled the point of order well taken.

An appeal was taken from the decision of the Chair, but by vote the decision was sustained.

On motion, adjourned.

FIRST DAY—EVENING SESSION.

The Association met at 8 o'clock, the President in the chair.

The minutes of the morning session were read, amended, and approved.

A letter of resignation from Dr. R. Finley Hunt was read by the Secretary. On motion, his resignation was accepted.

Miscellaneous business being in order, the following report of the committee appointed to confer with committees from other societies regarding consolidation was read by Dr. Harlan, the chairman:

The committee to whom was referred the matter of conferring with representatives of the American Dental Convention and the National Dental Association relative to uniting the three associations would respectfully submit the following report:

After fully discussing the question of the need of the profession being united in one representative body, and conferring with the other committees on this subject, your committee are of the opinion that it would not be wise nor expedient, nor would it materially contribute to that end, for this Association to disband, or in any manner assist in the formation of a new organization. Your committee desire nothing more than that the whole profession should be united under one banner, but they are unable to see in what manner this object can be attained, unless the members of the profession throughout the country come to this Association with properly authenticated credentials from their State or local societies.

In this way no section of the country is denied the privilege of being represented in a truly national body.

Your committee, therefore, believing that the American Dental Association

possesses all the requisite qualifications of a truly national body, would respectfully recommend that it take no action which would in any way tend to impair its usefulness or terminate its existence.

(Signed) A. W. HARLAN, *Chairman*,
F. H. REHWINKEL,
C. N. PEIRCE,
H. J. MCKELLOPS.

On motion of Dr. Webb, the courtesies of the floor were extended to Dr. George W. Field, of London, England.

Sections 2, 3, 4, and 5 were called, but none of them were ready to report.

Section 6 being called, Dr. Morrison made a brief report of cases in practice.

Dr. C. A. Brackett then read a report on "Certain Therapeutic Agents."

Dr. Odell, the chairman, followed with a report on "'Taking Cold' and Hyperæmia."

The subjects were discussed by Drs. Andrews, of Cambridge, Bogue, Buckingham, and Meriam, of Salem.

On motion, adjourned.

SECOND DAY—MORNING SESSION.

The Association met at 10.30 A.M., President Shepard in the chair.

The minutes of the evening session were read and approved.

Miscellaneous business being in order, the following report of the Committee on Directory was read by Dr. Stockton:

REPORT OF COMMITTEE ON DIRECTORY.

As chairman of the Committee on Dental Directory, appointed by you at the last meeting, I beg to report as follows:

Early in the winter circulars were sent to the different members of the committee, and the work received the hearty indorsement of nearly all the members. Later another circular was sent, with the intention of making the work more uniform. That, however, cannot very well be done without the aid of the various State and local societies throughout the country. On the 6th inst., I

mailed a postal card to the different members of the committee, asking for information in regard to the progress of the work. The answers received were a great surprise to me. With scarcely an exception, the work was well under way; quite a number of the lists were completed; the societies had indorsed the project, and will undoubtedly make provision for having them published, so as to be made available to all the dentists throughout the country.

The following lists have been received by me up to date:

District of Columbia, reported by Dr. R. Finley Hunt.
Indiana, reported by Dr. S. B. Brown.
Texas, reported by Dr. J. B. Tullis.
Kansas, reported by Dr. R. I. Pearson.
Missouri, reported by Dr. J. G. Harper.
Nevada, reported by Dr. W. O. Conwell.
Territories, reported by Dr. E. T. Darby.
New Jersey, reported by Dr. D. C. McNaughton.

This list will receive further and important additions when the Association meets at Boston, as the following gentlemen have notified me that they are ready or nearly so:

Louisiana, by Dr. George J. Friedrichs.
Virginia, by Dr. J. Hall Moore.
Kentucky, by Dr. A. D. Rawls.
Massachusetts, Vermont, and New Hampshire, by Dr. W. E. Page.
Rhode Island, by Dr. C. A. Brackett.
Maryland, by Dr. F. J. S. Gorgas.
Maine, by Dr. Thomas Fillebrown.
South Carolina, by Dr. T. T. Moore.
Illinois, by Dr. A. W. Harlan.
Wisconsin, by Dr. A. Holbrook.
New York, by Dr. S. A. Freeman.
Arkansas, by Dr. H. C. Howard.
Other States will undoubtedly respond.

For the State of New Jersey I would like to make a special report. At the last meeting of the State society, a resolution was adopted giving to each member of the society a copy of the list of Dentists in the State, also directing the committee to send a copy to each of the State societies, to the American Dental Association, American Dental Convention, Southern Dental Association, and to any other general organization that may hereafter be formed in this country. Also to sell to manufacturers of and dealers in dental goods copies of the directory at the rate of two cents per name, and at the same rate for all corrections hereafter. Another resolution was adopted calling for the appointment of dentists, residing at or near the county-seats, to advise the secretary of the society of the registering of any dentists at the county clerk's office. (The amendment to the law governing the practice of dentistry in New Jersey requires such registration.)

It will be seen by the foregoing that the list of dentists in New Jersey must, with very little care and trouble, be made nearly perfect each year.

Such a list must be valuable to the profession in a variety of ways. The dif-

ferent States are making laws for controlling and protecting the practice of dentistry, and, as a matter of record, the lists will be of great importance. Individual dentists throughout the country are continually making improvements, and to bring them before the profession in an inexpensive way, so that both buyer and seller will be benefited, is one of the reasons why I have advocated this work. Many dentists have improvements that are valuable, who will not have them patented, and who can make use of this directory to bring them to the notice of the profession.

I cannot too strongly call the attention of the members of State societies to the necessity of having their rules amended, or resolutions introduced so as to have the lists corrected each year. The work will be very slight when divided among so many, whereas, if the work is not corrected each year, there will be but little value to it in a short space of time.

In some of the answers to the circulars that were sent out to the members of the committee, I noticed that the lists were made up from lists in the possession of dealers in dental goods. While acknowledging the kindness of such dealers, I must add, that the profession as a body should be the leader of the dealer, and not the dependant. I feel that I need not offer my regrets at not being able to present my report in person when I can be so much better represented by Dr. Stockton.

All of which is respectfully submitted.

D. C. McNaughton, *Chairman.*

On motion, the report was accepted as a report of progress and the committee continued.

Dr. McKellops offered the following resolutions, which, after discussion by Drs. Atkinson, Darby, Morgan, Allport, Barrett, Mills, Buckingham, Shepard, Essig, and McKellops, were adopted:

Whereas, It is desirable that the dental profession, as a body, should give countenance to no other material for filling teeth than the best, and should encourage the greatest attainable thoroughness in the treatment of diseased teeth; and

Whereas, Of late years, many different alloys for the compounding of amalgams have been presented to the profession for their adoption, and put upon the market by the manufacturers, warranted to resist chemical change and thermal influence; and

Whereas, Some few members of the profession have seen fit to engage in the manufacture of said alloys for the formation of amalgams, and have used their position as professors to promulgate the doctrine of the superiority of amalgam compounds over all other materials as a filling for the preservation of the teeth; and

Whereas, Other members of the profession, holding responsible positions in some of our best colleges, have permitted their names to appear, indorsing advertisements setting forth the many fine qualities and rare virtues of these compounds, thereby giving countenance of a scientific character to their sale and use, and thus misleading many members of the profession who are but slightly

acquainted with the principles involved in the choice of the best filling material, since such men very naturally look up to the professors in their scientific character as authority in all such matters; and

WHEREAS, There is a peculiar impropriety in professors lending their names to the advertisements of these or any other compounds, inasmuch as charlatans lose no opportunity to exhibit and parade the names of such professors before an ignorant community, in justification of their constant use of an inferior material for filling teeth. Now, therefore,

Be it resolved, That this Association discountenance, in a formal and emphatic manner, the pernicious practice of members of the profession, and more especially those holding high positions in our schools, who allow their names to appear in advertisements as indorsing either any special material or compound for filling teeth, or any therapeutic agent whatsoever.

The regular order being resumed, the discussion of papers read by Section 6 was participated in by Drs. Morgan, Salmon, Werner, Atkinson, and Mills.

Subject was passed.

On Section 4 being called, in the absence of Dr. Keely the chairman, Dr. Darby made a brief verbal report.

On motion of Dr. McKellops, Dr. Joshua Tucker, of Boston, was invited to address the Association on Operative Dentistry.

After the conclusion of Dr. Tucker's remarks, a paper by Dr. John J. R. Patrick, of Belleville, Illinois, on "Oral Electricity and the New Departure," was read by the Secretary.

Discussion followed, participated in by Drs. Atkinson, Buckingham, and Allport.

Adjourned.

SECOND DAY—EVENING SESSION.

The Association met at 8.45 P.M., President Shepard in the chair.

The minutes of the morning session were read and approved.

Miscellaneous business being in order, the Executive Committee reported that they had examined the report of the Publication Committee and found it correct.

The report was adopted.

The Executive Committee also reported that they had audited the Treasurer's report and found it correct.

This report was also adopted.

On motion of Dr. Mills, a committee of five was appointed to draft resolutions touching the death of S. S. White. The President subsequently announced the following as that committee: Drs. Atkinson, Peirce, Taft, Morgan, and Mills.

The regular order being resumed, Operative Dentistry was further discussed by Drs. Allport, Morgan, Fillebrown, Thomas, Taft, and Atkinson.

On motion, adjourned to 9 A.M. to-morrow.

THIRD DAY—MORNING SESSION.

The Association met at 9.15 A.M. President Shepard in the chair.

The minutes of the evening session were read, corrected, and approved.

Miscellaneous business being in order, on motion of Dr. Essig, a vote of thanks was tendered to the dentists and dealers in dental goods, of Boston, for the entertainment of Wednesday afternoon.

The regular order being resumed, the discussion of Operative Dentistry was continued by Drs. Friedrichs, Lord, Stockton, Cook, Allport, Webb, Wetherbee, Mills, Niles, Waters, and Wilson.

Dr. Talbot, of Chicago, presented to the Association a set of instruments of his devising, intended for enlarging the canals of the inferior molars.

On motion of Dr. Atkinson, the Association accepted with thanks Dr. Talbot's gift.

Section 5 being called, a paper was read by Dr. Barrett, of the Section, on "Anæsthesia."

The rules were then suspended in order to call the roll for verification.

The regular order being resumed, Dr. Barrett's paper was discussed by Drs. Werner, Atkinson, and Shumway.

On motion, the rules were suspended and miscellaneous business introduced.

On motion, it was resolved to change the order of business for this evening so that the election of officers shall follow the organization of sections to-morrow morning.

On motion, adjourned.

THIRD DAY—EVENING SESSION.

The Association met at 8 P.M. The President, Dr. Shepard, in the chair.

The minutes of the morning session were read and approved.

Miscellaneous business being in order, a communication was read from the Secretary of the Art Museum very politely offering the freedom of the Museum to the members of the Association.

On motion of Dr. J. H. Smith, of New Haven, a committee of three was appointed to draft resolutions respecting the death of Dr. H. L. Sage, of Bridgeport, Connecticut. The Chair subsequently announced the following as that committee: Drs. J. H. Smith, W. H. Jones, and James McManus.

On motion of Dr. Taft the following was adopted:

Resolved, That a committee of five be appointed to take into consideration the feasibility of holding an International Dental Congress.

The following resolution was offered by Drs. Atkinson and Crouse:

Resolved, That the Publication Committee be instructed to confer with publishers to secure the best terms for the publication of the Transactions of this body, with authority to give such portion of the matter as the publishers may wish, as a part or as a full compensation, and that the Publication Committee have discretionary power to accept or reject any or all offers.

This was laid on the table till to-morrow morning.

Moved by Dr. Thomas, that the resolution, under the operation of

which a salary of one hundred dollars each is paid annually to the Treasurer and Secretary, be and is hereby rescinded, from and after this meeting. Lost.

The regular order of business being resumed, the further discussion of Dr. Barrett's paper was continued by Drs. Barrett, Brophy, Wilson, Buckingham, and Werner.

On motion, the regular order of business was suspended to hear a paper on Ethics by Dr. Marvin.

On motion, it was agreed to hear the report of Section 3 on Nomenclature and Terminology, which was read by Dr. Atkinson, the chairman.

Adjourned to 9 o'clock to-morrow.

FOURTH DAY—MORNING SESSION.

The Association met at 9.45 A.M. President Shepard in the chair.

Minutes of the evening session were read and approved.

Miscellaneous business being in order, the resolution of Drs. Atkinson and Crouse was taken from the table and adopted.

The regular order being resumed, Section 2 was called and a report on Education was read by Dr. Crouse, the chairman.

The following resolution, as recommended by the Section, was then adopted:

Resolved, That in order to secure representation in this Association, dental colleges must, subsequent to October 1, 1881, require all students entering therein to take two full courses of lectures previous to coming forward for examination and graduation, and must also state these conditions in their next annual announcement.

Dr. Brophy then read a supplemental report, and Dr. Fillebrown read one by Dr. Ingersoll.

These were discussed by Drs. Allport, Morgan, Buckingham, Stockton, Moore, Templeton, Barrett, and Wetherbee.

On motion, the subject was passed and the rules suspended to enable the sections to reorganize, which they did with the following result:

SECTION 1. Artificial Dentistry, Chemistry, and Metallurgy.—C. S. Stockton, Chairman; C. C. Carroll, George F. Grant, H. A. Baker, W. H. Fundenberg, Eben M. Flagg, D. G. Harrington, E. Honsinger, R. G. Richter, S. A. Freeman, E. S. Gaylord, William H. Trueman, J. E. Blake, John Allen, William Barker, Joseph Bauer, Seneca B. Brown, T. L. Buckingham, J. W. Curtis, C. W. Clement, W. P. Church, Henry Cowie, J. Cleland, C. S. Clark, J. O. Cook, H. W. Coburn, C. S. French, P. K. Filbert, J. L. Hill, W. Storer How, O. F. Harris, C. S. Hurlbut, W. H. Jones, J. U. Lee, M. B. Preble, Edward Page, E. J. Roberts, D. D. Smith, J. M. Sherman, J. W. Scarborough, A. C. Walker, J. A. Watling, G. A. Young, C. H. Biddle, H. H. Jackson, D. C. Kelly, A. E. Lyman, W. E. Magill, Charles Merritt, E. Osmond, F. A. Hunter.

SECTION 2. Dental Education.—Thomas Fillebrown, Chairman; J. N. Crouse, C. N. Peirce, Thomas H. Chandler, Charles D. Cook, H. A. Smith, S. J. McDougall, G. A. Mills, J. G. Templeton, T. W. Brophy, E. S. Talbot, Thomas T. Moore, W. W. Allport, E. A. Bogue, J. H. Smith, Thomas C. Stellwagen, W. H. Morgan, C. J. Essig, L. D. Shepard, R. W. Browne, G. W. Klump, C. W. Spalding, L. L. Buckland, E. S. Holmes, J. M. Hurtt, L. C. Ingersoll, D. C. McNaughton, C. A. Kitchen, C. A. Kingsbury, E. Noyes.

SECTION 3. Dental Literature and Nomenclature.—W. H. Atkinson, Chairman; J. Taft, W. A. Bronson, H. F. Bishop, Charles Bullock, J. H. Batchelder, A. Colton, Charles E. Francis, W. B. Knapp, Joseph Lathrop, A. L. Northrop, L. C. Taylor, S. M. Cummins, W. S. Moores, J. S. McMillen.

SECTION 4. Operative Dentistry.—M. H. Webb, Chairman; A. H. Brockway, J. W. Rhone, Charles H. Osgood, I. J. Wetherbee, W. E. Page, E. T. Darby, S. C. G. Watkins, J. S. McCampbell, H. J. McKellops, J. Frank Marriner, George L. Field, M. L. Chaim, W. H. Colgrove, Charles Miller, W. P. Leavitt, A. N. Priest, S. G. Perry, George J. Friedrichs, William H. Goddard, S. D. Stewart, J. H. Coyle, W. G. A. Bonwill, F. N. Seabury, D. F. Whitten, J. Searle Hurlbut, G. R. Thomas, Charles F. Allan, G. C. Daboll, O. R. Post, C. P. Wilson, D. B. Ingalls, T. D. Shumway, George H. Wilson, S. G. Stevens, G. W. Hoysradt, J. McManus, H. B. Noble, H. Eugene Smith, Dwight M. Clapp, A. W. Buckland, S. H. Guilford, C. A. Marvin, G. B. McDonald, John G. Harper, K. B. Davis, George W. Keely, S. B. Palmer, S. B. Barfield, Benjamin Lord, C. R. Butler, C. C. Chittenden, W. C. Dyer, William Dutch, Charles E. Dunn, A. F. Emminger, William Jarvie, Jr., Henry W. Morgan, H. L. Ambler.

SECTION 5. Anatomy, Physiology, Histology, Microscopy, and Etiology.—W. C. Barrett, Chairman; M. S. Dean, J. G. W. Werner, E. S. Niles, George F. Waters, Robert R. Andrews, C. T. Stockwell, George H. Cushing, Leon Rideout, E. Hunter, J. T. Codman, Isaac B. Davenport, S. W. Dennis, D. S. Dickerman, E. B. Davis, J. N. Davenport, E. G. Leach, G. W. Stoddard, S. F. Stearns, Ira A. Salmon, Frank Abbott, G. V. Black, C. F. W. Bödecker, D. C. Hawxhurst, J. C. Hanks, J. Hooper, E. D. Swain, W. H. Allen, C. F. Wheeler.

SECTION 6. Pathology, Therapeutics, and Materia Medica.—Frank M. Odell,

Chairman; W. N. Morrison, A. M. Dudley, A. W. Harlan, C. A. Brackett, M. F. Finley, C. S. Beck, A. W. Tenney, Gorton Nichols, I. Douglass, A. W. Freeman, Robert Huey, A. M. Holmes, E. S. Holmes, J. W. Hill, A. O. Rawls, F. J. Richards, Joshua Smith, J. S. Swartley, William Taft, George W. H. Whitaker, J. C. Whinery, I. P. Wilson.

The regular order being resumed, and Section 1 being called for, Dr. Stockton read a brief report, which was followed by a supplemental paper on Artificial Dentistry, by Dr. Eben M. Flagg, at the close of which, by motion, the Association proceeded to ballot for the next place of meeting.

New York City was selected.

Balloting for officers was then proceeded with, resulting in the election of the following:

President—C. N. Peirce, of Philadelphia.
First Vice-President—W. C. Barrett, of Buffalo.
Second Vice-President—George J. Friedrichs, of New Orleans.
Recording Secretary—George H. Cushing, of Chicago.
Corresponding Secretary—A. M. Dudley, of Salem, Mass.
Treasurer—Wm. H. Goddard, of Louisville.
Executive Committee—W. H. Morgan, of Nashville; S. G. Perry, of New York City; T. T. Moore, of Columbia, South Carolina.

The following resolutions offered by Dr. Peirce were adopted:

Resolved, That the Treasurer be instructed to pay all properly-authenticated bills.

Resolved, That a vote of thanks be tendered to the Local Committee for its very admirable arrangements, which have so largely contributed to our comfort and enjoyment during this session of the Association. Also to the reporters of the public press for their excellent reports, and to the proprietors of Hotel Brunswick for their liberal arrangement and superior accommodations.

On motion of Dr. Cushing, it was resolved that the Association desires to gratefully express its appreciation of the courtesies of the city of Boston, as extended to it in the sail through the harbor, and to the Mayor for his graceful attentions upon that occasion.

On motion of Dr. Taft, it was resolved that the hearty thanks of this Association be extended to its retiring officers for the very efficient and satisfactory manner in which they have performed their arduous duties.

On motion of Dr. Cushing, the special thanks of the Association

were tendered to the authorities of the Massachusetts Institute of Technology for their very generous gift of the use of their building for its benefit, whereby it has enjoyed unusually good accommodations.

On motion of Dr. Klump, a vote of thanks was extended to the retiring President for his untiring and successful personal efforts to make our stay here pleasant and long to be remembered.

A vote of thanks to the officers of the Art Museum for their courtesy was also passed.

The President announced as the Committee on International Congress, Drs. Taft, Peirce, Cushing, Bronson, and McKellops.

On motion, Dr. Shepard was added to the committee, and on motion of Dr. Taft, Dr. McManus was also added to it.

Resolutions regarding the death of Dr. H. L. Sage were presented by the committee to whom the matter had been referred, and were unanimously adopted. They will be found in the memorial pages.

The committee appointed to draft resolutions touching the death of Dr. Samuel S. White made their report. Appropriate remarks were made by Drs. Morgan and Barrett, after which the report was unanimously adopted by a rising vote. The report and remarks will be found in the memorial pages.

On motion of Dr. Crouse, the newly-elected officers were installed.

The Chair appointed Drs. Atkinson and Taft to conduct the President to the chair.

The retiring President introduced Dr. Peirce with brief and appropriate words, which were in like manner responded to.

The President appointed as the Local Committee of Arrangements Drs. Perry, Northrop, and Mills.

Also, as members of the Publication Committee, Drs. Darby and Dean.

The following notices of amendments to the constitution were presented:

By Dr. Priest.

To add to Section 5, Article III., of the constitution, under the head of "Permanent Members," that after the resignation of a member has been accepted, the Association may at any time thereafter reinstate such member by unanimous consent.

By Dr. Dean.

To amend Section 1, Article VI., of the constitution so that the first sentence shall read, "To prepare, arrange, and expedite business, this Association shall be divided into *seven* sections, as follows:"

And to change Section 5 to Anatomy, Histology, and Microscopy.

And to add Section 7,—Physiology and Etiology.

The minutes were then read and approved, and the Association adjourned to meet in New York on the first Tuesday in August, 1881.

In Memoriam.

DR. SAMUEL STOCKTON WHITE.

HE is not here in bodily presence, but he is here in the spirit and effect of the work he accomplished here in the flesh. We miss him for the first time at this our annual coming together in sweet accord of fellowship. It is therefore fitting that we should record here and now a sense of *our great loss* inflicted upon us by his advancement to better spheres and higher activities. He was with us from the beginning of our organization, THE man of most potency in holding us together for the good of the whole, by kindly consideration and justice of treatment of each individual as necessary to the efficiency of all in the exercise of the duty of each to other. He was a man of quick apprehension, quiet demeanor, and of moral grandeur excelled by none.

It is but recording the sentiments he entertained to say that the excellency he maintained among us was the result of the daily consciousness of an OVERRULING POWER among men, obedience to whose behests ever brings the highest success in all the activities of earthly existence. He was our best example of the comprehension and practice of "The Gospel of Commerce."

Overworked in mind, body, and affections, he has been cut off in the midst of a pre-eminently useful career, and we submit to that dispensation that we have not the strength to acquiesce in, of which strength he was so full by reason of his devotion of all his energies to his ideal source of all POWER.

Resolved, That a memorial page in our Transactions be set apart for this.

Dr. MORGAN: It is proper on occasions like this that we should halt in the busy whirl of life and pay a tribute of respect to the memory of him who has gone from among us to return no more, and to take to our hearts anew the truth, the solemn truth, of the mortality of our bodies.

Samuel Stockton White was a prince among men; but he is gone, and we shall never again clasp his generous hand or meet his kindly greeting in our annual convocations. No one was more thoroughly identified with this Association, or more ardently desired its success than he; and now that we shall never again listen to his wise and

friendly counsel, we realize that indeed a prince in our Israel has fallen.

My business acquaintance with him commenced in 1847, my personal acquaintance and friendship in 1858, when I first met him. I think I came to know him thoroughly, and I honored and loved him well.

Dr. White's most striking traits of character were founded upon and grew out of his abiding faith in the wisdom and goodness of an overruling power. Deep down in his nature he had an unwavering trust (as he expressed it to me) in, and daily communion with, a Heavenly Father.

In early life he studied and practiced dentistry, and he became more and more thoroughly identified with it both as a science and an art, while life lasted. After he ceased to practice and embarked in business, he contributed to its wonderful progress more than any man of his day or time, especially in the way of improving and furnishing improved materials and fixtures for its practical details. His love of dentistry as a profession was exhibited to some extent in the many large and generous sacrifices he made to promote its interests; often at a heavy outlay of money, known only to a few of his personal friends, he purchased patents and appliances and quietly laid them aside, because he knew they would not be a benefit, but an injury to the profession, if made and sold. In this and other ways he spent thousands of dollars, of which he rarely spoke, and then only to intimate friends.

He possessed a self-command, I think, superior to that of any man I have ever known. When bitterly and unjustly assailed once, in my presence, and it seemed that any man of proper self-respect would have resented it by violent means, he with dignity forbore, and when asked how he could stand that, he calmly replied, "That man does not know me; he is mistaken in my character, and I can afford to wait until he discovers his error." And the result vindicated his wisdom. Others might, and many would, under such provocation have taken vengeance into their own hands; but this man, in his moral grandeur, wrapping his mantle of greatness around himself, could say, "I can afford to wait!"

Let us cherish his virtues, imitate his noble example, that we may, as he did, have daily communion with our Heavenly Father while here on earth, and when we go hence, as go we must, we may, like him, have a home with the blessed and good.

Dr. Barrett: *Mr. President*,—I desire to express my hearty con-

currence in the words of fitting eulogy so tenderly spoken by Dr. Morgan. A name exhaling sweeter fragrance was never left the legacy of family and friends; and if with us, who had but professional and business relations with S. S. White, that perfume lingers yet, and the air even now seems hallowed by an angel presence, how dear must be that memory to those who were bound to him by stronger ties and who walked continually in the light of his uprightness! If to us the remembrances of his presence are stimuli to nobler lives, what must his example be to those who stood continually near his side! "The memory of the just is blessed."

DR. H. L. SAGE.

It having pleased an all-wise Providence to call from the scene of his earthly labors and usefulness our esteemed brother, Dr. H. L. Sage, of Bridgeport, Connecticut; therefore

Resolved, That with deep regret the American Dental Association has learned of his decease.

Resolved, That in the death of Dr. Sage the Association has sustained the loss of one of its most zealous members, and the community an excellent and useful citizen.

Resolved, That we accord to his memory a heartfelt tribute of respect, and tender to his surviving family our condolence and sympathy in their heavy bereavement.

Resolved, That the Secretary be requested to send a copy of these resolutions to the family of the deceased.

SECTION VI.

PATHOLOGY, THERAPEUTICS, AND MATERIA MEDICA.

REPORT BY W. N. MORRISON, OF THE SECTION.

Cases of Diseased Antrum.

MR. H. (age 24, good health) came to me with a swollen cheek, attributing the cause to a tooth. The second molar had a medium size gold filling in the crown (anterior sulcus), upon removing which and drilling a short distance I discovered a live pulp. I covered it up again, gave the case a little more time to define itself, and on the next day the plug of mucus was started from the antral foramen by blowing the nose, and a considerable quantity of serum was discharged. The swelling subsided and the patient was well in a few days.

Another case, Mrs. B. (age about 40, delicate, nervous organization), complained of pain and soreness on the right side of the face and in the ear. The second superior molar was dead, and the pulp exposed in the third molar. I applied disinfecting dressings in the cavities for a day or two without benefit. On a second or third visit the patient said she had stooped to pick an article from the floor when she felt something give way in her nose, and quite a discharge, "about the consistence of machine oil," came away. This patient steadily improved.

Another case of long standing was where a right superior molar was extracted to relieve a similar swollen face, but without good results. After being treated by a general practitioner for nasal catarrh until his money was all exhausted, the patient was sent to a dentist to have another tooth extracted and his teeth generally looked after. The dentist found the antrum engorged with a semi-solid secretion which would not wash out, but had to be pumped out with a syringe, and coiled like a rope on the spittoon as it was discharged from the syringe. After evacuating the cavity and medicating with dilute carbolic acid, the patient was discharged cured. Treatment was made through the socket of the anterior buccal root of the molar extracted about three months before, and which had not

closed. The physician had not discovered anything wrong about the antrum, but had treated the patient for nasal catarrh.

It is this class of cases and others equally marked by abnormally enlarged cheek-bones that we should ourselves treat, or see that other specialists do examine that particular field of the mucous membrane. I recommend that the natural opening into the nares be enlarged and used where it is at all practicable in treatment. This offensive and distressing malady with which so many of our patients are afflicted (largely among the children) could be greatly relieved, and in many cases entirely cured, by a little dental assistance or friendly communication with a brother specialist.

SECTION VI.—Continued.

REPORT BY C. A. BRACKETT, OF THE SECTION.

Certain Therapeutic Agents.

IT has been well said that the work of this body should be mainly addressed to the discussion of broad general principles, and that matters of detail should be left to the smaller local societies. While fully appreciating the soundness of this proposition, I find it impossible to present what I wish to present without going somewhat into detail. I have also to apologize for the frequent use of the personal pronoun. The egotism manifested thereby is mainly seeming, for only a small part of the matter of this paper can be claimed as having been developed by my own investigations.

I will endeavor to be as concise as I consistently can in bringing before you a few points within the field of Section VI.

The first of these relates to the modification and control of the flow of saliva by medication, with a view to lessen the difficulties and annoyances of operations in very wet mouths. Physicians have long recognized certain effects following the exhibition of belladonna. The "United States Dispensatory," in the edition of 1874, and I think likely in earlier editions, has this statement concerning belladonna: "Among its first obvious effects, when taken in the usual dose and continued for some time, are dryness and stricture of the fauces and neighboring parts." The leading statement under the head of

"Medical Properties and Uses" is, "The action of belladonna is that of a powerful narcotic."

Dr. A. F. Angell, a practitioner of medicine and dentistry in Newport, R. I., presented the dental uses of belladonna to the Rhode Island Dental Society, at its annual meeting in July last. Dr. Angell claims that, reasoning from the facts just named and constantly verified in general practice, and stimulated by the necessities of a trying case then in hand, he originated, in the year 1870, the use of belladonna with the definite object of controlling the salivary secretions. He claims, further, that from that time to the present he has practiced its use in the class of cases in which it could render the greatest service, and always with the happiest results. It is claimed not only that the flow of saliva is almost completely controlled, but that nervous sedation very grateful to the patient is also induced.

To produce these effects in aid of the dentist the dose may be for an adult, of the fluid extract of the root, from five (5) to twelve (12) drops. This is the most concentrated liquid form of belladonna, and it will be well to keep in the neighborhood of the smaller quantity till familiarity with the drug and its effects is attained. Other preparations of belladonna may be used, if preferred, in quantities the equivalents of those named. For a child the dose should be proportionately reduced.

The second point to which I would ask your attention is the liability of producing injury to the teeth by the acid nature of oral medicaments which we may employ carelessly or thoughtlessly. My attention was called to this matter only a few days since by the following case: While engaged in cleansing the teeth of a gentleman whose mouth has for many years been in the care of one of the best practitioners in the country, I could not fail to notice a broad, ragged excavation in the enamel on the labial face of the right superior central incisor, It was developed that the gentleman had a few months previously been advised to make frequent applications of tannin to his diseased gums. This instruction he had followed more than faithfully, and he was positive that this excavation had taken place within the time in which he had been making use of the tannic acid. At various times during previous years I had operated in and examined the mouth of the patient, and this excavation had never been noted, as I am sure it would have been if present; nor have I ever seen in any other mouth an appearance like it. On testing with

litmus paper a specimen of tannic acid from my own case, I found the reaction so marked that the conclusion that it was the active agent in the etiology of the condition present seemed irresistible.

In "Magitot's Treatise on Dental Caries," translated by Professor Chandler, we read this "conclusion" as the result of several experiments extending over a period of two years: "Tannin is a special alterant for the ivory [*i.e.*, the dentine] and cement, its effects being probably produced by previous fermentation with fermentation of the derived acids; but its action, which is produced only at a considerable degree of concentration, need not, in our opinion, receive any very important application in the pathogeny of dental caries."

It should be stated, however, that the strongest solution of tannic acid used by Magitot in his experiments was one part to one hundred parts water. Sound teeth freely exposed to the action of that solution for two years at the ordinary temperature showed no appreciable alteration in the enamel, which was merely covered with a light deposit of a greenish coloring-material, but had kept its polish and its ordinary hardness. The roots showed a marked softening of their substance, which, at the same time, was stained a light-brown color, and could be penetrated by an excavator to some depth.

In the case of the patient of whom I speak the crystals of tannin were themselves applied to the teeth and gums.

Stimulated by the revelations in this case, I have made a series of tests of a few of the agencies we are using with more or less frequency in the mouth, and I will put the results before you. Of course the list contains many materials which we have probably all known to be acids. I think it contains a few that some of us would hardly have suspected of acidity to the degree which exists.

These strips of litmus paper were dipped respectively in the materials named and carefully dried before being placed in the neighborhood of each other. The appearances now are substantially the same as when the tests were made, except that from the exposure to the air for several days the untouched portions of the paper have lost something of the blue color. The mucilage with which the strips are fastened is also acid, as you will see. The water with which the fresh solutions were made was rain-water, and tests of it alone proved it free from acid.

It should be stated that the case of erosion named, and which was my stimulus to make this demonstration before you, was first brought to my attention only four days since. Hence my work has been hastily done, and is not so complete as I would desire.

[The writer of the report here exhibited strips of litmus paper that had been respectively treated with these substances, viz.:

Fresh saturated aqueous solution tannic acid.

Saturated aqueous solution alum (kept some months in stoppered bottle).

Fresh aqueous solution phosphoric acid.

Prof. Wetherbee's Dental Obtundent.

Fresh aqueous solution salicylic acid.

Ordinary alcoholic tincture myrrh (kept some months).

Mixture of glycerin two (2) parts, deliquesced chloride of zinc one (1) part.

Mixture of glycerin two (2) parts, tincture aconite root one (1) part.

Deliquesced chloride of zinc.

Liquid of Fletcher's Artificial Dentine.

Liquid of Smith's Oxychloride of Zinc.

Liquid of Agate Cement.

Liquid of Poulson's Cement.

Paste of Fletcher's Dental Porcelain.

These strips, except the one dipped in the liquid of Fletcher's Artificial Dentine, exhibited marked acid reactions in different shades of red color.]

Both tannic acid and alum are used so commonly and so freely in the mouth as astringents and styptics that the need of caution in regard to them is not imaginary. Alum is also an ingredient in some of the tooth-powders of questionable character.

It seems hardly necessary to say that all such dentifrices must exert a deleterious influence. I question, also, whether any preservative qualities of tannin in connection with carbolic acid and cotton as a canal filling, as recommended by one of our best operators, may not be more than counterbalanced by the acidity of the first-named substance.

Concerning alum, even in attenuated solutions, the conclusion of Magitot is, "Alum, a mineral substance slightly susceptible of fermentation, respects absolutely the dentine and cement of the teeth, and destroys with great energy the elements of the enamel."

Dr. Wetherbee's Obtundent gives a deeper red tinge to the litmus paper than does the simple solution of phosphoric acid. The solution used in the test was, however, not a strong one.

The acid reaction of tincture of myrrh is so much of a surprise to me that I doubt if all specimens would show the same; but none of that in my office gives any different result.

When salicylic acid was brought to a place in the dental materia medica, among the uses for which it was recommended, one was as a medication of cotton to be used for canal fillings. As such I tried it, and the results were gratifying, so far as the subsequent comfort of the tooth was concerned; but, having occasion for other reasons to remove two or three canal fillings of this kind, the evident rapid progress of white decay in the canals during the interval they had been so filled induced me to entirely renounce its use for that purpose. The practice of sealing in a tooth any substance which test-paper pronounces acid, and which has such affinity for tooth-structure as to be capable of disintegrating it, appears worthy of condemnation.

Specimens tested of glycerin, absolute alcohol, tincture of aconite root, and fresh aqueous solution of John Wyeth & Bros.' compressed tablets of chlorate of potash were found free from any acid reaction, but combinations may be acid though their component parts were not. The mixture of glycerin and tincture of aconite root shows about the same acid reaction as glycerin with chloride of zinc. Allusions to these combinations will be made again farther along in the report.

The most brilliant acid reactions are produced by chloride of zinc and the liquids of the various white cements. In combination, however, with the powder this acidity is supposed to be neutralized; and the results of their use certainly corroborate the theory. As was to be expected, the liquid of Fletcher's Artificial Dentine—the non-irritant pulp-capping—is only slightly acid. The specimen tested was not from a freshly-opened bottle.

These tests might be carried much further, doubtless with profit, if time and disposition permitted. Enough, however, has been said and shown to convey the point intended, viz., that many of the medicaments often used in the mouth by dentists are actively acid; and they should be applied with the intelligence, the care, and circumspection requisite when dealing with agencies of that class.

It is with hesitancy and diffidence that I approach the consideration of the third and last subject I have to place before you. This feeling arises from my own inability, in the nature of things, to decide conflicting claims and to do justice to each gentleman who has or has had connection with the matter. As the only New England member of Section VI., I feel it my duty to report something of the recent progress that has been made, and it seems worse than pla-

giarism to use the material kindly placed by my own request in my hands without giving credit therefor. I have given the matter much thought, and have tried to pursue the best course. I am well aware that there is much in my report that is not within the limits usually set for papers of this character, but unreservedly I affirm that I have no affecting personal preferences, or any object whatever, other than the presentation of such truth as I have been able to gather. At any point at which I may err, I trust to be set right.

It is in proof of the fact that our poor human nature is not absolutely depraved that long experience does not take from the good practitioner the feeling of shrinking from the infliction of pain. A very large part of what has been considered necessary pain in dentistry has come from the excavation of cavities. Hence have arisen the many attempts at prevention and alleviation which have been brought out in years past. These we have all tested without general and complete satisfaction. One of the simplest means, and perhaps the one to which resort has most universally been had, has been the exclusion of the oral fluids during the process of excavation, it having been plainly recognized that a dry cavity is less sensitive than a wet one. The reason for this, I suppose, is, as has been said, that in obtaining the dryness we are depriving the tissue of one of its natural elements, and hence its capacity for conveying impressions is curtailed. Until lately, little if anything has been suggested in the way of accomplishing this dryness other than mechanical means.

The newly-published idea in the treatment of sensitive dentine is that we should supplement the mechanical means of dryness with chemical means of dryness,—*i.e.*, we should use as obtundents materials which have such an affinity for water as to take it from the dentine. This is the broad general principle; the details may be worked out in various ways.

In practice it is found that materials which have this greedy affinity for water, when applied alone in sensitive cavities, themselves produce pain from the rapidity and force of their action; hence arises the necessity of making combinations, of using them in connection with such adjuvants and such corrigents as shall make their action substantially painless while still effectual.

Prominent among the substances which have this affinity for water and are in all respects harmless are glycerin and absolute alcohol. With one or the other of these is combined tannic acid, chloride of zinc, tincture of aconite root, etc.

So far as I know, the first formal public claim of having originated the idea which we are discussing, and having put in practice both the absolute alcohol and the glycerin, was made by Dr. T. D. Shumway, of Plymouth, Mass., in a paper read before the Massachusetts Dental Society at its last annual meeting, held in Boston on the 3d and 4th of June of this year.

As is well known to many of you, Dr. Shumway has for many years advocated the packing of cohesive gold with broad, smooth ivory points,—simply rubbing down, "ironing" down, one smooth layer of gold upon another,—the theory being that all that is necessary to accomplish the perfect welding of gold foil is that one smooth, clean, dry surface be placed against another smooth, clean, dry surface and gently pressed into perfect apposition. Practically, in the mouth, this requires great care to accomplish. Dr. Shumway's paper states that quite a number of years ago, in order to practice with the best success his peculiar method of manipulating gold, he found it very desirable to obtain greater dryness of the surface of dentine in cavities than the usual means of obtaining dryness could command. This increased dryness he found he could secure with absolute alcohol or with glycerin. From their use for this object he came to see their value as obtundents. He states that he has found one of the most satisfactory ways of using glycerin to be in combination with tincture of aconite root,—two (2) parts of the former to one (1) part of the latter.

Dr. Shumway's claim is that for more than seven (7) years he has steadily practiced the use of these means for lessening the sensitiveness of dentine, and that he was their original inventor in the way described. He claims, further, that the preparation known as "Näbolï" was developed from statements of his concerning his use of these materials, made directly and indirectly, to persons who have since become prominent in bringing out Näbolï.

Dr. C. G. Davis, of New Bedford, Mass., also claims to have discovered the more essential ingredients of Näbolï, and to have communicated the same to the President of the Dennett Dental Näbolï Co. Dr. Davis's statement, as made to the Massachusetts Dental Society at the meeting already named, is, in substance, that having an excruciatingly sensitive cavity to prepare some months previously, he tried the greater part of obtunding agents within his knowledge without appreciable benefit. In desperation, he took from his case a bottle whose contents had been procured for another purpose. Applying this material and waiting a little, he found to his surprise and

delight that the excavator could be used comparatively without pain.

Dr. S. J. McDougall, of Boston, writes: "I have found a preparation of the following, of value for obtunding sensitive dentine:

℞ Absolute alcohol, ℥ss;
Glycerin, ℥ss;
Tannic acid, ʒss.—M.

Also,

℞ Absolute alcohol, ℥ss;
Glycerin, ℥ss;
Chloride of zinc, ʒss.—M.

"In all cases where possible use the hot-air syringe. That—the hot-air syringe—I consider more valuable than all else combined. . . . Hence heat applied to the tooth is at the present time the *best* obtundent we have. . . ."

Dr. McDougall at different times supplied several other dentists with his combinations, without, however, revealing their ingredients then. Among the Boston dentists so supplied were Dr. H. E. Dennett and Dr. S. F. Ham, to each of whom was given the absolute alcohol, glycerin, and tannic acid preparation. This was as early as 1878. Concerning his claim for originality, Dr. McDougall makes this written statement over his signature, under date of July 29, 1880:

"I did, positively and absolutely, 'personally and independently' originate those combinations which I sent you for obtunding sensitive dentine."

The explanation of these apparently conflicting statements I believe to be that different men, working independently and each in his own way, arrived at similar results. It is very far from being the first instance in which substantially the same thing has had different discoverers. It is more than probable that others than those named have explored some part of the same field, but so far as I know the first open publication of these points was made at the time and place and by the gentlemen stated.

At the same meeting of the Massachusetts Dental Society, Professor I. J. Wetherbee, of Boston, by request, gave the formula of a combination which he has since placed in the market under the name of "Wetherbee's Dental Obtundent." The formula is:

℞ Concentrated solution phosphoric acid, ʒi;
Chloroform, ʒii;
High-proof alcohol, ʒvj to ʒviij;
Sulphate of morphia, gr. cxxv.

The ingredients to be added to each other and rubbed up in a mortar in the order named.

As has become quite generally known, there has been organized in New England within a few months a stock company claiming to be the owners of a valuable patent right for obtunding sensitive dentine. This company makes a business of selling the material, and granting, for a considerable sum per year, office-licenses to use the same. The way in which this company has come into existence, the nature of its claims, and its ability to substantiate them, are such that it has failed to secure the respect of the better portion of the profession who have acquired the most knowledge concerning it. Early in the summer Dr. A. M. Dudley, of Salem, Mass., spent considerable time and money in thoroughly investigating the character of The Dennett Dental Näbolï Company and the validity of its claims. The results of this investigation he laid before the Massachusetts State Society, and that body promptly, emphatically, and without a dissenting voice, passed resolutions adverse to the claims of the corporation. Among other matters presented by Dr. Dudley was the result of a chemical analysis of Näbolï made by Professor B. F. Davenport, of the Massachusetts College of Pharmacy. Näbolï is contained in a series of four bottles, with directions to apply from the contents of each to the cavity in the order of their numbers. In the specimen that he examined Professor Davenport found the contents of No. 1 to consist essentially of sweet oil; of No. 2, sweet oil with a little tannic acid; of No. 3, glycerin and much more tannic acid; of No. 4, chloroform. The contents of all the bottles were scented with attar of rose. I have also here a copy of an analysis made somewhat later for Dr. McDougall by Professor Babcock:

[COPY.]

10 ROLLINS ST., BOSTON, June 14, 1880.

DR. S. J. MCDOUGALL:

Dear Sir,—I have examined with considerable care the contents of four bottles contained in a small wooden package, and marked "Dennett's Dental Näbolï," the bottles being numbered No. 1, No. 2, No. 3, and No. 4, each bottle having the word "Näbolï" stamped in red wax upon the cork, and each having revenue stamps canceled by the letters "D. D. N. Co."

The results of my examination and analysis are as follows: No. 1 contains a preparation of petroleum oil, resembling "vaseline," perfumed, and incorporated with a very small quantity of tannic acid.

No. 2 is in all respects like No. 1, except that the proportion of tannic acid is somewhat greater. No. 3 consists of glycerin, perfumed, and holding in solution tannic acid, but in considerably greater proportion than either Nos. 1 or 2. No. 4 contains what is known as wood-naphtha, or methylic alcohol, a product of the distillation of wood, and holding in solution various empyreumatic impurities which give it its peculiar odor and acid reaction.

Respectfully, JAMES F. BABCOCK,
Analytical and Consulting Chemist.

A more recent analysis, made under more favorable circumstances, by Prof. Davenport, and verified by another Boston chemist of high standing, who, from motives of delicacy, asks that his name be withheld, makes this showing:

Bottle No. 1. A paraffine oil, with a trace of tannic acid.

No. 2. The same oil, with a larger proportion of tannic acid.

No. 3. Glycerin and tannic acid.

No. 4. Chloroform and alcohol.

All perfumed with attar of rose.

There is substantial agreement in the different analyses concerning the essential parts. Several facts should be stated in explanation of the minor discrepancies that appear. Some of the analyses have been made under peculiar difficulties. One of the earlier ones was made with only ten drops from each bottle. Further, it is hardly likely that all the Näbolï placed upon the market has been of strictly uniform composition.

In view of all that is now known concerning dental obtundents, the haste which some practitioners made to bind themselves under a multiplicity of conditions, and become licensees of a corporation with no better claims for exacting tribute than has this one, seems hardly wise. If successive experiences, such as we have had with patent rights and royalties, do not teach us to look before we leap, we must be blind indeed.

In regard to the merits of the different materials and combinations that have been named in this report, it can only be said that the tests so far have not been sufficiently general and extended to positively determine their value. It is hardly reasonable to expect anything magical or miraculous from any of them. My own experience, very limited yet, would lead me to say that if we do have such expectations we are doomed to disappointment. I believe that one favorable thing can be said of all of them. Properly used, with careful after-

neutralization and cleansing of the cavity, none of them are likely to do harm. They are as worthy of trial as anything within our present knowledge. Some of them may prove of real merit in alleviating the pain of our operations; and if so, patient and practitioner will alike rejoice.

SECTION VI.—Continued.

REPORT BY FRANK M. ODELL, CHAIRMAN.

"*Taking Cold,*" *and Hyperæmia.*

IN this report I propose to treat upon the subject of "Cold," as popularly applied in the sense of "taking cold," as the phrase runs.

This pathological manifestation is by many physicians considered to be merely the result of hyperæmic induction of nutritive and functional disorder, generally nominated "catarrh," and variously classified, according to the location of its most prominently active symptoms.

I think I may with confidence assert that its etiology is not yet sufficiently clearly understood to admit of either such prompt measures in therapy as shall invariably and at once abort its progress, or such others in prophylaxis as shall prevent its inception; much less such accuracy of prophasis as may surely predict its termination.

The predisposition to catarrh is varied by individual peculiarities of age, birth, occupation, sex, and all that these subdivisions may imply in development from infancy to old age; and consequently we often hear our medical attendants explaining (?) in answer to our question as to *cause*, "it is owing to increased susceptibility of the mucous membrane," or, "of the skin, to thermal changes:" all of which is an assumption of wisdom embodying nothing of explanation, although passing for a reply.

In terser parlance, diathesis and cachexia are the twin helmsmen who never forsake their post; and an acquaintance with the chart which they invariably spread will enable us to do much toward the safe piloting of our patients' "bark of life."

But to whatever causes we ascribe the catarrhal conditions which may present, the more immediately pressing symptom is always that of a hyperæmia, of territory more or less extensive.

Hyperæmic condition of territory is the resultant of neural inadequacy, permissive of undue acceleration of nutrient currents, followed by stasis, directly productive of suppression of normal, and therefore induction of abnormal, functional activity on the part of corpuscular or epithelial bodies.

This condition cannot be met by direct specifics; none such exist; but once the diagnosis being correctly made out, our sensible course is to so act upon the neural and vascular currents as to supply nutrient material to suffering elemental tissues or bodies; in other words, atony must be superseded by tonicity: some tissue is starving for lack of its proper pabulum, either *directly* withheld, or merely from inability to appropriate that for which it craves, but which nevertheless may, in an unavailable form, be present in abundance.

Tonicity may sometimes be regained by stimulant applications; at other times by reduction of vascular tension; and again by restoration (direct supply,—feeding) of elements, either positive or negative, indispensable to polarization (satisfaction) of molecular or atomic affinities.

Usually, the first departure from the regular nutrient or respiratory exchanges of elements in tissue would be in consequence of undue retardation or acceleration of currental movement, *autonomically corrected by the elemental bodies themselves.*

Therefore it is that congestion in capillaries is not always best met by direct applications of ice, nor that the algidity of one suffering from hæmaturia should call for *hot* applications. In the former instance, it is well understood that hot-moist external applications, by relieving the tension, first cuticular, then vascular, suffer the currents to resume their motion, and thereby normal status of all the involved tissues is the more readily resumed. In the latter instance, the gelid creature lying so helplessly, with stertorous breathing, and lips and tip of nose already shading heavily with blue, seems like anything else rather than a subject for applications of ice; yet ice above all things, applied immediately to the hypogastric region, and long continued, is, to her, life! whilst stimulants and heat would at once reinstitute the bleeding, and a moribund state would be reached in rapid metre.

So, likewise, in the treatment for catarrhs; it is well to scan all the history of each particular case before adopting any line of treatment. It is, too, imperative to remember the mutual relations of organs capable of exercising vicarious functions.

A knowledge of the physiology of catarrh teaches us that after

abnormal heat-loss the body has recovered its temperature with a *plus*, which has resulted in pyrexia; ordinarily defervescence follows, and the normal standard of temperature is reached and maintained. Therapeutically, we can hardly do better than to follow and assist these natural processes.

If consulted in the first stage, some hot fluids—alcoholic, if you please—and a full dose of paregoric or Dover's powder at bed-time, would be quite sufficient.

In the later stages, however, with dry, hot skin, and congested condition of epithelial lining of respiratory tract, perhaps with dyspnœa and cough, it is better to at once excite cutaneous action; so we give such medicament as shall set up a gentle action of the bowels, in counteraction of the natural tendency to constipation in such cases, and also a single large dose of compound powder of ipecac, to induce profuse diaphoresis; or the same action may be induced by a warm bath, followed by a plentiful hot drink of lemonade, with a wine-glassful of whisky or brandy therein, the alcohol here acting as one of the best of diaphoretics; and the liability to an accession to the catarrh on rising in the morning is overcome by a cold douche, quickly taken, and immediately followed by vigorous drying, and by another wine-glassful of alcoholic fluid well rubbed into the epidermis. Any bland oil or fat may be substituted, but I give preference to the alcohol.

Then to fortify the citadel against relapse, a course of iron and vegetable tonics, with a little oil of cod-livers, and good living (which includes all that can be said about regularity of habits and sufficiency of sleep), are measures not only advisable, but often simply indispensable to a complete recovery.

Because the systemic condition which *permitted* the aberrations of function resulting in the catarrh is generally but the natural sequence of privation of needed *exercise*, *sunlight*, *fresh air*, or *sleep*, or a combination of these hardships.

It may be objected that bathing with pure spirits or alcohol is unphilosophical and anti-physiological, because the skin is an *excreting* and *secreting*, and not an *absorbing*, surface.

To this I reply that this is a dilemma presenting not the traditional *two* horns, but *five;* each of which, however, is, like the "horns of the altar" in ancient Jewish history, a horn of safety.

They may be summed up under the following heads:

1st. Physical signs, or the evidence derived from ordinary observation and feeling.

2d. Chemical phenomena.
3d. Physiological aspect.
4th. Pathological view.
5th. Empirical demonstration.

From the first point of consideration—viz., physical signs—I take the old and familiar example of immersion of the body in fresh water, and its effect upon thirst. This is an exceedingly crude experiment, and the fact that no perceptible diminution of thirst should follow long continuance therein does not in the least militate against the proposition of absorption of fluids, because thirst results from the natural demand of *every* tissue of the organism, and of each and every living corpuscle thereof, requiring, as *a priori* may readily be predicted, more fluid than the most ardent advocate of dermal absorption would ever expect to introduce by that channel.

But let the bath be of water impregnated with salts of potash or soda, or with the latter and a trace of iodine as in sea-water, and upon attempting to dry the surface of the skin, it will be found that its furfuraceous layer has parted with much of its sebaceous lubricant and replaced it with water; nay, more, that this layer appears to have actually swelled and imprisoned a quantity of water between or within its folds or scales, and that a stimulant application, such as alcohol, is now felt, not only locally, but systemically; and aside from its action upon the immediate surface of contact, a decidedly tonic influence is exerted upon the whole epithelial surface, internal as well as external.

Further argument in support of this will be seen in my fifth postulate.

2d. *Chemical Phenomena.*—In this second aspect of the subject medical records prove that carbolic acid, when applied to the dermal surface, needs no previous preparation of the latter, in order to permit of its absorption. From its own affinity for fluid, and its corrosive action when applied to dermal surface, carbolic acid readily makes its way through the furfuraceous layer. Its continued action (which, if upon an extensive surface, would result disastrously if not interfered with) can be readily controlled by application of glycerin; and its subsequent elimination by the kidneys and other emunctories is proof of its having been absorbed.

Another instance of this chemico-physiological absorption—for the two actions run so into each other that the dividing-line is almost imperceptible—is found in the action of hydrocyanic acid, absorption.

of which is rapidly fatal, merely from *contact* with dermal surface, without mechanical friction.

From the third or physiological aspect it is easy to educe the feasibility of dermal absorption, because, with the exception of the furfuraceous layer, we have every element favorable.

First, we have a system of epithelial bodies surrounded and interlaced and overlaid with a complete network of capillaries, the circulation in which constitutes a most ready channel for absorption; and then we have, as the next most efficient factor in the process, a system of enveloping lymphatics, or intercapillary spaces or lacunæ, giving an independent and rapid transit for suitable fluids from the periphery toward the circulatory centre. Again, in the epidermis, which I have granted to be an impenetrable layer (as to absorption) to a certain extent, we have only to kick up a slight dust in the superposed or furfuraceous layer, so as to deposit among its scales some vaccine lymph, and presto! we have inoculated our patient with cow-pox.

4th. From a pathological view of the action of epithelial bodies, I have only to refer to the urinary vesicle, which, although generally permitting no absorption during life, is perfectly permeable after vitality has departed; so that by a parity of reasoning, whilst in a strictly physiological condition absorption might not take place by dermal epithelia, it would be quite possible and probable in *pathological* conditions. And this view is again sustained by the fact that the urinary bladder often permits of concentration of its contents, the dissolved matters remaining, whilst the purely watery portion is absorbed.

5th. *Empirical demonstration.*—The word "empiric" comes to us from the Greek, and signifies "a trial," and was the ancient honorable appellation indicative of those physicians who, rejecting theory, practiced only upon those principles sustained by experience alone. It is only by us moderns that the term has come to be used rather as one of reproach, but even when so used it is oftener merely with an *assumption* of superior knowledge than on account of any just ground for such a claim. In fact, I feel justified in asserting that empirical practice has always led the way for scientific research. Empiricism made assertions, and in part, at least, demonstrated them. Scientific investigators plodded along after, and gave the *reasons* for such results. It is simply another instance of man's dependence upon man, it being so ordained that no *one* is in himself complete.

So the Iatraleptes (immediate successors of Æsculapius) treated

all diseases by external means only—viz., by unguents, frictions, laying on of hands, etc., and from the days of Jesus Christ down to our own time much success has attended their efforts.

It is not therefore to be wondered at that modern physicians have made use of some of these means to ends; nor that the practice of greasing the throat and chest with goose-grease still obtains in cases of croup and diphtheria; nor that catharsis is obtained by means of croton-oil rubbed upon the abdomen; nor that cod-liver oil has beneficial effects when applied in like manner; nor that the use of alcoholic epidermical applications *do* stimulate the skin, and not only prevent the renewed want of action termed "taking cold," but promote a feeling of general warmth and a freer action of the pulmonary ciliated epithelia.

And all this is purely empirical, and much of it in apparently direct contradiction of the latest scientific evidence, which seems to prove that alcohol and oil are not absorbed by the skin, and that the corneous layer thereof is impermeable by them.

Yet the fact remains that these substances *and many others do act upon the organism, and by this means of ingress;* and I, as a truthful therapeutist, am obliged to express my conviction thereon, and unhesitatingly recommend what I have so often seen proven efficacious.

This action of alcohol, and its effect upon internal epithelial surfaces, is doubtless reflex (as I do not desire to intimate that temulence can be induced by any amount of bathing of the cutis with spirits), but we *must* have absorption to produce any action whatever other than momentary,—as by corrosive or destructive action productive of shock,—and the immediate effect of the application here recommended is to substitute a feeling of general well-being for one of discomfort, freedom of respiratory movement in lieu of respiratory obstruction, due to a normal desquamation of the epithelia instead of an abnormal dissolution or fusion, the former product being exhaled or otherwise imperceptibly disposed of, whilst the latter product is often driven out only after herculean expiratory efforts, and in some (frequent) instances not at all, but serving in its further retrograde metamorphoses as the nucleus of graver complications.

Upon the external epithelium the treatment produces a precisely similar effect, resulting in the gentle "insensible perspiration" instead of that overflow of watery product known as *sweat*, which in its aberrant production is so distressfully weakening to the system, in that the latter is thereby too rapidly deprived of its soluble salts of potassium, sodium, calcium, iron, etc.

From the foregoing it will be readily perceived that, although by no means a *disciple* of Hahnemann and Hering, I must necessarily practice often upon the principle of *Similia similibus curantur.*

For another instance, illustrative of this mode of procedure, refer again to the early stages of catarrhal disability. To the superficial observer the difficulty is to be met only in the nasal-mucous membrane, or perhaps in the larynx or bronchia; but the more analytic mind will carry investigation much farther, and can hardly fail to perceive that the entire microcosm participates in the disturbance. If the dejections are considered, it will be found that the entire system of epithelial linings is working with energy to perform those respiratory or depurative functions which of right belong to the epithelia of the surfaces more immediately involved.

We do not by any means always have the pathological action so readily give way to physiological activity; hence the necessity for the caution to view the whole field before adopting any given course. The difficulty here under consideration may be complicated by diarrhœa, which, being accompanied with great prostration and articular pain, may seem to the patient the most troublesome symptom.

To proceed at once to the administration of astringents, carminatives, and analgesics would appear to be adopting a counteractive treatment directly opposing the malign forces manifesting themselves; but the result of such a method of procedure would frequently be to suppress a natural depurative effort and precipitate an uræmic explosion, the checking of this action increasing that of another locality, so that the kidneys, the liver, or other important emunctories might be made to suffer for such ill-timed interference.

In symptoms and treatment it is about impossible to distinguish between rheumatism, lithiasis, and gout; the latter seems often to have the preference in the medical mind, but if the practitioner does not desire to be immediately superseded by one who is discreet enough to call it rheumatism, he never speaks of the affection by its family name. However, as it is important in this connection that he should bear it in mind, it would be well to make diligent search for articular neuralgiæ, and learn sufficient of the previous history of the patient's habits to be guided aright as to possibility of lactic or uric acids preponderating in the system. This once ascertained, no wonder need exist that our cold or catarrh should intensify all the other symptoms, and be itself quite intractable under ordinary treatment; it has now, indeed, passed into another category, and may

give place to many localized inflammations, frequently terminating in cardiac disability.

Once having ascertained this condition to exist, I should, as an additional measure in furtherance of successful treatment, invest the patient in a jacket of woolen to be worn next the skin, in order to aid in one generally unrecognized function of the furfuraceous layer thereof, to permit of the *more gradual* dispersion of body-heat by *slow* transpiration, without the liability to sudden chill, to which an extensive moist surface is ever exposed.

Without following out the possibilities of my subject to their various termini, more or less fatal, my mission will have been accomplished if I have induced in your minds a disposition to give earlier and more considerate attention to what is commonly lightly passed over as "only a cold!"

DISCUSSION.

Dr. Meriam: In considering the destructive action of certain medicines upon teeth out of the mouth, it must be remembered that it by no means follows that the same results would follow their application to teeth in the mouth. We know that aromatic sulphuric acid would act strongly if applied to a tooth out of the mouth, but we do not see the same result as we ordinarily use it in our practice. This is, I think, due to the mucous coating upon the teeth.

Those who in old times did metal plate-work will remember that when they wished to clean a plate that had been worn, they had to boil it in soda and remove this coating before acid would act on it. This same coating is found covering the teeth almost like a varnish in some mouths, and acid medicines cannot, in such cases, come into *direct contact with tooth-structure*, which they must do to produce injury. Even teeth that look white and clean will often be found coated, and if touched with iodine will be stained. If one of such teeth be cleaned off with pumice, and iodine be then applied, it will be found that the tooth no longer stains, and the iodine can be easily wiped off. The point I wish to make is the protection given by this coating to the teeth in the ordinary use of acid medicines.

Dr. Andrews: It has been my custom to use litmus paper to test the secretions of the mouth, and in a great many cases I have found them quite acid; in fact, an acid reaction being shown in almost every case.

Where this condition exists, you will find, after having prepared a cavity for filling, that when tested it will show an acid reaction.

In these cases I moisten the cavity with a solution of bicarbonate of soda in water to fully neutralize the acid.

These facts seem to furnish a suggestion we should not ignore.

Dr. MORGAN: I think the subject of diseased antrum one of sufficient importance to engage for a short time the attention of this body. Dr. Morrison's report of cases was a very limited one, and confined to one form of those affections, and that in its earlier stages in the main.

He nominated it catarrh of the antrum, and followed it no further than the simplest form of engorgement.

Now, we have diseases of that cavity resulting from other sources than from the usual catarrhal affections. Sometimes it becomes involved in what is generally known as catarrh, and the disease passes along by the nasal cavity and is transmitted by the mucous membrane through the canal into that cavity and we have simply engorgement. Occasionally that engorgement takes a very serious form; the symptoms become formidable; there is pain of the face, neuralgic pain along the upper part of the spinal column, and dizziness, and that to such a degree that I have known the disease mistaken for softening of the brain.

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When it assumes so serious a form as that, mere local applications, as counter-irritants, are no better than shooting straws against the wind to arrest it. The cavity must be invaded, and whatever there is of an irritating nature accumulated there must be removed, and the patient put upon constitutional as well as local treatment.

With a scrofulous patient, where the disease has continued for a few months, and there is a lowering of the vital forces, it is necessary to do more than remove the cause of the local trouble; the patient must be placed upon a tonic and stimulant course, and the general system built up. This is particularly necessary where local affections run readily into the destruction of the parts, such as necrosis of the bone.

Some years ago there came into my hands an old gentleman, between seventy-five and eighty years of age, who had been suffering for six or eight years. He had been confined to the house, and had worn a seton in his neck for many months at a time. He was relieved by the opening of the antrum, and by injecting the cavity first with mild escharotics, and afterwards with a mild stimulant. More recently, a patient strongly inclined to scrofula and consumption came

into my hands after many months of suffering. Giddiness and inability to walk about the house were the prominent symptoms, and a physician had diagnosed his case as softening of the brain.

Six weeks of vigorous treatment—opening the antrum immediately below the malar process with a trephine, cleansing the cavity, and stimulation of the parts—resulted in an entire recovery. There was a slight relapse two years afterwards that was very easily managed.

Very frequently, engorgement of that sinus is the result of decayed teeth, and it may originate with any of the teeth. I recently saw a case caused by a canine tooth. The patient was in rather poor health, and spent much of his time in a recumbent position, and the pus which was formed at the root of the tooth gradually percolated back and passed into the antrum, and an engorgement was the result, with violent inflammation and unfavorable general symptoms.

In these cases the first step in the treatment should be a vigorous one, and that is an invasion of the cavity, so that the condition of the parts may be fully understood. If there is necrosis, it should be treated on general principles, and the patient should be put upon a tonic course which will build him up.

Dr. WERNER: I think a case of necrosis of the walls of the antrum should not be treated by applications of escharotics or acids. In such cases a surgical operation is necessary, and the less you inject into the cavity the better. I think that this is generally true in all cases where the antrum is involved.

Affections of this cavity generally start with inflammation of its mucous membrane, which is very susceptible to inflammation, and the great principle to be observed, in my experience, is to keep the parts warm and stimulate them. The use of escharotics and acids is painful to the patient; they destroy the mucous membrane, and will leave a sore and painful condition for many days, weeks, or months.

If warm salt water be used, it will be found effectual, and not painful; but if the least acid be used, say carbolic acid, it will be almost intolerable, for such treatment would irritate the parts and produce an eschar which would have to heal by granulation. Such treatment is not at all indicated where the bone is involved. I have lately treated a case of diseased antrum from the right superior first bicuspid, whose pulp had died two years previously.

After two years, abscess of the antrum was developed, starting from abscess of the first bicuspid.

The best results were obtained by mild injections, simply to wash and cleanse the cavity.

A very nice outward application is flannel saturated with hot rum or brandy.

Dr. ATKINSON: One that knows anything about the subject before us can hardly go astray if he will ignore fancies and hold his mind closely upon the business in hand. You have been warned by the last speaker against irritation. Do we know what irritation is?

It is the kindly friend that operates the entirety of the nutrition of the body. When you push it beyond the point of *nutrient* irritation it becomes *pathological*, and you had better not urge it beyond that point.

As to the applications to inflamed parts, you will avoid warmth if you know what will be good for your patient. Inflammation is inflammation in whatever territory it is located, and he who resorts to poulticing is on the way to destruction; use either hot or cold applications.

We want to have our attention called directly to this point,—what constitutes irritation? It is a disturbance always where it is in excess of the normal blood-tension.

The blood-tension is governed by the vaso-motor system of nerves, and I need not say another word to you if you have not studied that.

What is abscess of the antrum?

You will never get abscess of the antrum until you have occlusion of the outlets of the antrum. I have known abscess to run ten years, and remain with nothing but a glairy fluid in the cavity, and simply washing with salt and water, as recommended by the last speaker, would be all that would be necessary for a cure if the patient were as healthy as that condition would indicate. As to the case of a cuspid being the source of irritation that induced disease of the antrum, that is explained simply upon a mal-organization, or an abnormal organization of that particular spot of the maxillary bone, its sinus coming forward so that the cuspid penetrated it. Very often this is the case with the bicuspid, and sometimes of the incisor also.

What is the other point of importance for dentists to understand? That they never get local inflammation that is destructive where there is no constitutional deterioration of the protoplasm of the body. There must be that deterioration of the juices of the flesh that indicates want of satisfaction of the molecular metamorphosis, which is called strumous, scrofulous, cachectic, syphilitic, and a thousand other nonsensical expressions that we have studied and memorized without comprehending the signification of. Some of the best pathologists say that scrofulous tendency is inherited syphilitic cachexy.

Sometimes, but very rarely, disease of the mucous membrane may be so aggravated as to seize upon the surfaces of the bones, and thereby induce caries, or even necrosis, but to him who is conversant with these cases there will be very little difficulty in ascertaining when the bones are diseased.

If they are diseased there is but one remedy, and I was very glad to hear the last speaker say that that was a surgical operation. The surgical operation may be performed by the intelligent manipulator, or it may be left to nature to set up the vaunted lines of "demarkation" between the living and the dead bones. Would to God that I had the power to sweep away as with a besom of destruction all the abominable, false, and ridiculous teachings on the subject of caries and necrosis that darken every text-book on surgery that I have ever seen!

We are taught to believe that nature sets up a line of demarkation, and that it is good practice to await this event before attempting to remove the "sequestrum"!

That is the doctrine of the schools and of the books, and I put it right in the teeth of all you surgeons, whoever you may be, everywhere, if that is not a correct presentment of the teachings.

The true doctrine in medicine, as in morals, is to right a wrong action the moment it is known to be wrong. *Make* a line of demarkation for every case by an early extirpation of the necrotic point. This is best done by the engine burr.

Dr. WERNER: Did the doctor mean to say that we could not have inflammation without constitutional deterioration?

Dr. ATKINSON: I did say that most emphatically, and I give you in proof this instance: No animal in its natural condition ever has inflammation when it is wounded; for its wound always heals by "first intention" if not meddled with. All healthy human organization heals always without inflammation, from any wound that has not a directly destructive poisonous concurrent impression upon the nervous system. The doctor does not discriminate between inflammation and irritation; he does not discriminate between *nutrient* irritation and that which is destructive. You know that they have said that there is adhesive inflammation. That is simply cohesive nonsense.

What I want to say is this, that there is always a letting down from the standard of health in the protoplasm where inflammation occurs from the breaking of any tissue.

Dr. WERNER: I claim that in certain stages of inflammation warmth

is the best treatment, and that cold applications are detrimental. Here the inflammation begins where it cannot be seen, and it cannot be known at what moment.

It is necessary to discriminate with regard to the state and location of the inflammation, and hence modify its treatment.

It may be true that we can abort inflammation by application of cold if we could know where it begins; but how are we to know that? It may begin with the least irritation of the vaso-motor system.

How does the doctor discriminate between irritation that is nutritive and that which is pathological?

Dr. MILLS: I have had a case of diseased antrum under treatment during the last winter which has given me much practical information, and helped me to understand some things better than I did before. A lady about forty years of age came into my hands. She had been under the care of another practitioner for a distressing case of Riggs's disease, and desired my treatment of this particular difficulty.

I found the case far from having been reached, excepting in spots, and I pursued the course which I am accustomed to do in these cases, and with success as to Riggs's disease; but, contrary to my expectation, I found the patient still in a state of unrest, which she had been all the time associating with the difficulty now cured.

From a remark dropped some time afterward, that on using her handkerchief she found that there was an exudation from the nose, I was instantly led to suspect the trouble to be in the antrum. An examination revealed, at the posterior buccal surface of the third molar, a little inlet to the antrum into which I could run my probe, with care, about two inches, and when I withdrew it there came a very unpleasant odor with it.

Of course I knew there must be trouble there. My treatment of the case was largely in the line of Dr. Atkinson's method. This treatment differs so entirely from that of Dr. Werner that I wish to speak of it because of the success which followed. Having satisfied myself that there was no deterioration of bone, I commenced using injections of lukewarm salt water, but after two days I found there was a good deal of obstruction. I could throw the injections up to a certain point, at which there seemed to be a pressure which caused considerable disturbance. I fell back upon the idea of exciting active inflammation. I injected aromatic sulphuric acid in its full strength, which caused a good deal of pain for the time being, but the results which followed after twenty-four hours were certainly very satisfac-

tory. The activity of the inflammation thus set up was the means of getting rid of the local difficulty.

One or two dressings of that kind, and a mild treatment, consisting of keeping the cavity open and thoroughly cleansed, enabled me after thirteen or fourteen days to bring that antrum into a state of rest and comfort, and with the exception of one slight relapse, the patient has never had any more trouble.

I speak of this as showing the good results which followed this treatment, which I think were obtained in much shorter time than would have been the case by the milder treatment. There are cases undoubtedly presenting a very slight disturbance, in which mild treatment would be all that was necessary.

SECTION IV.

OPERATIVE DENTISTRY.

REPORT BY E. T. DARBY, CHAIRMAN *pro tem.*

THE Section on Operative Dentistry is not a little embarrassed in making its report, in consequence of the absence of the chairman, Dr. Keely. The Section has but one paper to present to the Association, but would suggest the discussion of a few subjects which seem to be of sufficient importance to warrant the Section in directing attention to them at the present time.

The first of these is the replantation and transplantation of teeth. A member of the Section reports having met, a few days ago, at one of our local societies, a gentleman who assured him that a friend of his had shown him sixteen cases of transplantation, and in his judgment they promise success. The replantation of teeth is more common in this country than the transplantation of them, but it is probable that many of the members present have had one or more cases of transplantation, and the history of such cases cannot fail to be of interest to the Association.

Another subject that the Section deemed worthy of consideration is plastic materials and the improvements that have been made in them during the past year. It is not intended to introduce the theories of the so-called New Departure men, but simply to bring forward the improvements in materials for discussion. The improvements in the preparation of gold for filling teeth—such, for instance, as platinized gold, which is being used extensively by some—are also suggested for your consideration.

There is no more fit time or place to discuss the improvements in operative dentistry than now and here.

The Association will be pleased to learn of the presence in this assembly of Dr. Joshua Tucker, of this city, one of the oldest, if not the oldest, practitioners in the United States. At the earnest solicitation of some members of the Section he has consented to address the Association. He will perhaps speak to you upon some subject

closely allied to operative dentistry, possibly relating to the use of the old soft foil.

Dr. Tucker's name and reputation are familiar to the dental profession, and it will be a pleasure to this entire body to see his face and hear his voice at this time.

SECTION IV.—Continued.

VOLUNTEER ESSAY BY JOHN J. R. PATRICK, OF BELLEVILLE, ILL.

Oral Electricity and the New Departure.

IN questions of physics, or the laws governing material substances, mere opinion is often confounded with demonstration. I believe that most men are honest in their statements concerning their experience, their experiments, and their observations; but these must be capable of verification and demonstration, otherwise we should be in the condition of the man who resolved to regulate his watch by the town-clock, but would not inquire whether the town-clock was right or not. Outside of the known laws which govern the properties of matter, all becomes conjecture; and as there is no limit to the possible conjectures one may make regarding things beyond the power of demonstration, there can be no end to the disagreements that will arise if we permit ourselves to embark upon this troubled sea of dignified guess-work.

The materials used for filling teeth cannot be intelligently discussed independently of the tooth-substance and its surroundings. Every element that enters into the composition of the living body, and every substance that is likely to come in contact with the material used for filling the teeth, the chemical affinity of the several substances present in the mouth, and the energy or force set free by molecular change, must all be considered before a scientific deduction can be established.

Opinions and theories of men, based on their own experience and observation, especially when such experience relates to scientific matters or manipulative skill, include so many undecided questions, that it is not only unscientific, but dangerous, and even frivolous, to hastily adopt them. The frequent failures in filling teeth with gold by the

most conscientious operators—men who spare no pains to perform their work to the utmost of their ability—are too apt to lead them to seek the cause of failure outside of themselves; for no man who honestly does his utmost is willing to suspect a lack of manipulative skill as the cause of his failure. No man feels composed under the imputation of a want of skill in his profession. If he is an imaginative man, he at once seeks redress and an explanation of his failures in a wild wilderness of speculation, in which there is no definite coherence. Hypothetic currents of electricity are mixed up with incompatibility of tooth-substance, chemical interaction, and filling material. Imagination unconsciously takes the place of reason, the inventive faculty is exercised in the interests of previous expectation, and emotional experiments are prosecuted with all the outward appearance of scientific accuracy—for scientific instruments are used (or rather abused) with automatic activity, regardless of the laws of exact association, and in the interests of the dominant idea. There are so many obscure phenomena connected with electricity, so much of its action is undecided, and not reduced to law, that it offers superior inducements to persons of a marvelous tendency to revel in its mysteries, and to float in confident security, like the atoms of Epicurus, in a void.

There are other causes that have been equally as fruitful as defective manipulation in creating a belief in the superiority of plastic filling.

1st. The continued appeals on the part of patients for inexpensive work. For instance, it is frequently the case that a well-dressed man, wearing diamond jewelry, will request his dentist to use the cheapest possible material; and a majority of women will spend more money in one year with their milliners than they will with their dentists in ten years, and still feel the tax of the dentist the heavier of the two.

2d. The ease of the patient and operator in the use of plastic materials.

3d. The more profitable employment in a monetary point of view to the operator.

4th. The deep interest shown by the champions and promulgators of this old system revived in putting compounds of their own manufacture upon the market.

Prof. J. Foster Flagg has given to the world his pamphlet on the "Basal Principles of the New Departure," and declares that he is but the mouth-piece of Prof. Henry S. Chase and Dr. S. B. Palmer,

and fully indorses the creed of these two gentlemen, that "The electro-chemical theory of the action of filling material and tooth-substance, and the incompatibility of gold with 'Dentos,' make gold the worst material to use for saving teeth."

Prof. Flagg further states in his pamphlet that with the assistance of Prof. Morton, of Hoboken; Prof. Snyder, of Philadelphia; Messrs. Eckfeldt and Du Bois, assayers of the Philadelphia Mint, together with Drs. Palmer and Chase, dentists, he has "carefully and scientifically investigated, with the best instruments and apparatus the country has produced, every line of experiment which professed to show a current, which they believed to be eliminated by contact of metal with tooth bone, and found that such current had never been shown, much less measured." So that Prof. Flagg falls back upon belief and his own acknowledged failures to preserve teeth with gold for the hypothesis of electric currents destroying tooth-bone when gold is employed in filling teeth.

Prof. Flagg betrays the influence of some of the inducements I have enumerated for using plastic fillings in preference to gold, when he says that "teeth are safer in the hands of the majority of practitioners turned out from our schools with a plastic material for filling than with gold." This is a humiliating confession, and so much the worse for our professors and our schools; for the dentist who cannot manipulate gold, either for plate or for filling, must take a back seat; he has no business in the profession. Notwithstanding the failure to demonstrate the electric current, Dr. Flagg constantly refers his readers to the two dental electricians, Drs. Palmer and Chase, and informs us that letters by the score passed between Syracuse, St. Louis, and Philadelphia on the subject, and that finally these three gentlemen were ready to promulgate the doctrines of the New Departure, or, more properly speaking, they were ready to present to the profession some new honey that they had abstracted from old hives. In reviewing the published experiments of Dr. Chase, which are indorsed by his co-laborers, I find them so full of fallacies, contradictions, and misconstructions of physical law, that a few instances will suffice to render his whole line of experiments worthless. On pages 201 and 202 of the *Missouri Dental Journal*, for the year 1876, the following sentences occur:

"1st. The oral cavity may be compared in some sense to a single cell of a voltaic battery.

"2d. Where the teeth are all sound and the oral fluids are in a perfectly physiological condition, the mouth is not a voltaic battery.

"3d. There is probably more or less electricity evolved in the ordinary mouth nearly all the time, more especially if there is a tooth plugged with any metal whatever."

Here are three equivocal statements, if not contradictions. The first compares the mouth to a voltaic battery, the second denies it, and the third sustains the first proposition.

On pages 202 and 203 the doctor states a well-established law in electro-metallurgy,—that "The electric current passes from the positive element to the negative one, and that element is positive which is most easily acted upon by the fluid in which the elements are immersed; and that element is negative which is less acted upon." In other words, the positive pole is that metal which is dissolved, and the negative pole is that metal or substance upon which the metal is being deposited by the influence of the electric current, electricity simply being the carrier of the metal from the positive to the negative pole, as in the electrotype process. On the same page (203) the doctor says that "*dentos* is a bad conductor of electricity, and therefore it is a negative element in the *oral battery*."

I reply that a tooth is a good conductor of electricity, since it is permeated by the fluids of the tubuli. For proof of this assertion, grasp one of the poles of a battery and bring the other pole in contact with the teeth, which will readily determine this question. If "dentos" were a negative element in the "oral battery" and the filling material positive, by all the laws of electro-metallurgy the filling material would go to the "dentos" (the place where it usually is needed), not the "dentos" to the filling material. In other words, the metal filling being positive must waste away and be carried by the current to the "dentos" and be deposited upon it either in the form of salts or of metal, and the dentine will remain intact.

The whole of page 204 is devoted to contradicting his former statements, and to promulgating a few electrical impossibilities. One instance will suffice: "The electrical action between two substances is none the less on account of the resistance offered to the passage of the current."

Now, it is a well-established fact among electro-metallurgists that the negative pole is only considered as acting the part of a conductor, and resistance to the passage of a current stops the action.

On page 205 he says, "A piece of muscle impacted between two teeth will produce considerable of a current, which is usually so annoying that removal of the substance seems an immediate necessity to the individual."

Of course, when an electrician has the cause to investigate, this annoyance could not be produced by the simple effect of mechanical pressure.

On page 208 the doctor recommends the use of tin and gold, and describes the method of using them: "But the better method to use tin and gold in the same cavity is to employ cylinders of tin only, and of gold only, always keeping the tin next to the walls of the cavity and using only gold in the centre of the plug." I will simply state that the interposing of tin between gold and the substance of the tooth as a protector of the dentine from the action of the gold (if such action existed) would not affect the polarity in the least; the tin would act merely as a conductor. But if I wished to form a little cell or electric combination in the mouth by the simple contact of two metals, I could hardly devise a better method, for gold being one of the most negative of metals, a feeble action might take place between the two.

Currents produced by contact alone are always extremely weak. A much stronger current would take place between an amalgam of zinc and one of silver, placed in the same position, for, although silver is not as negative a metal as gold, it possesses the highest conductive power of all metals. The tooth-substance would not be a factor in the case, for we all know that tooth-substance is composed of salts, which always impede electric currents, the gelatine and water being the only material in the tooth that could act as a conductor. A desiccated tooth would be a complete insulator.

Gold is not attacked by any single acid (except selenic), does not tarnish in dry or moist atmosphere at any temperature, and is not affected by sulphur, iodine, or phosphorus. Tin, on the contrary, tarnishes or oxidizes slowly in moist atmosphere. *Its oxides combine with vegetable acids*, and its salts in solution will attack and combine chemically with the substance of the teeth. Its power to chemically unite with tooth-substance is only equaled by mercury and silver. When new compounds are formed by the chemical affinity of elementary bodies, and change of molecules takes place, or when compounds are recompounded by the same agency, organisms may be destroyed or built up. In either case passive or active electricity may be evolved. This law of chemical affinity is beautifully illustrated in the incubation of an egg. It is well known that the body of an egg contains neither phosphoric acid nor lime, but both these substances exist in the shell, which becomes thinner and thinner during the whole time of incubation, till the living embryon appropriates a sufficient quan-

tity for the formation of its bones; part of the albumen combines with the shell for this purpose, and another portion forms the feathers.

It is also remarkable that though phosphate of lime is always present in the urine of adults, it is not found in the urine of infants; the rapid formation of bones in the first periods of life appropriates all of this salt eliminated. So we can rest content, if the phosphate of lime is present in the urine, that the supply is greater than the demand for it in forming tooth-substance.

What Dr. Chase and his co-laborers wish to prove is, that gold, from its power to resist chemical action, is to be considered the worst material for filling teeth, because it is one of the most negative of metals,—that is, that the dentos is dissolved and goes over to the negative pole; but by his own confession his instruments do not indicate that dentos is a positive element in his oral battery. Dr. W. C. Barrett, of Buffalo, New York, in his very able review of the so-called "New Departure," very successfully quotes Dr. Palmer against himself. In a paper read before the State Dental Society of New York, in 1874, Dr. Palmer says, "A porous tooth containing an amalgam plug has in it the elements of a minute but intense *battery* capable of decomposing not only the plug but the tooth around it." This early statement of Dr. Palmer's proposes an impossibility, for gold, silver, platinum, and tin, fused together and then reduced to filings and afterwards amalgamated with 60 per cent. of mercury, *would not* and *could not* polarize to form an electric combination, much less a "battery." The molecules of each separate metal would be positive and negative to each other in such a confusion of infinite quantities that they would neutralize each other's action. I know of no means of forming an electric combination in the mouth except by filling a superior tooth with a zinc amalgam and an inferior antagonizing one with a silver amalgam, so that they would come in contact. Then I admit that a circuit would be formed through the moist tissues of the mouth from the zinc to the silver, and, in case of an acid condition of the fluids of the mouth, electric excitement would take place every time the two metals came in contact;—if the fluids were neutral, electric excitement would take place feebly.

That electric currents should be generated in the mouth, and that when present they should be destructive of bony tissue, so far from being true from a scientific point of view, is not, I think, even theoretically possible, for the following reasons:

1st. The electric taste is an excessively delicate test of an electric

current; signals may be tasted which even the most delicate galvanometer will fail to detect.

2d. Very strong currents of electricity have been used daily for months and years as a therapeutic agent in cases of paralysis, and it is in constant use as a stimulant to tetanize dormant muscle, without being in the least destructive of bony tissue.

It is not electricity that does the mischief; it is defective filling with gold and a change of molecules in other materials used for filling teeth, and this takes place when no current could be perceptible. Diffuse electricity may take place on the decomposition of any substance, but it must be remembered that electricity is the result, and not the cause, of molecular change.

In the June (1877) number of the *Missouri Dental Journal*, on page 223, Dr. Chase sums up the results of his experiments and observations, and embodies them in the following sentences: "Gold is not oxidizable in the mouth, and in itself may be said to be permanent, but the tooth suffers more from that fact. *It is the tooth-substance* that does not last; the metals of which plugs are made *last* long enough. Their slow surface chemical disintegration is *desirable* in an acid condition of the mouth. A plug that will not do this is a greater enemy to dentos than one that will." These sentences need no comment.

In the *Journal* of July 15 of the same year the doctor gives freely the results of his experiments in dental alloys, and publishes three formulas. The first formula contains equal parts of gold, silver, and tin, amalgamated with 80 per cent. of mercury, or, if 20 parts of tin filings are added, 60 per cent., which makes 146⅔ parts of tin, silver, and mercury, and 33⅓ parts of gold. This amalgam, while it contains so small a proportion of gold, is far richer in that metal than any alloy in the market, for where platinum is used it only takes the place of gold or divides the honors with that metal.

Now, why use gold at all? If gold is incompatible with tooth-substance, so is platinum. Why use these expensive metals in such connection? Are there no fears that this seductive and dangerous gold will corrupt the virtues of the other four metals? Is it not a short-sighted liberality to use it in such connection when it is useless? But if it be dangerous to the integrity of tooth-substance, is it not culpable?

When Thomas Fletcher produced the platinum and gold alloy, it was an improvement on Dr. Townsend's amalgam of tin and silver, as much so as Dr. Townsend's amalgam was an improvement on the

zinc and tin amalgams in use forty years ago; and I can assure you it was no spasmodic fit of emotional generosity that induced Fletcher to add the gold and platinum to the silver and tin of Townsend and smelt them together, producing a more intimate connection of their particles than could have been obtained in the filings of the separate metals. The wide difference of expansion and contraction of the several metals under thermal influence is to a trifling extent compensated thereby. This was his object, and this is why test-tubes were introduced. The elements that are constantly present in the body, that unite directly with silver, tin, and mercury, were no consideration with Thomas Fletcher, and, as far as this controversy has gone, I am not aware that they have been introduced by any one. I, therefore, with the tenderest regard for electricity, beg leave to present for your consideration, sulphur, iodine, and phosphorus, a trinity of elements which have a great attachment for silver, mercury, and tin. But more especially do I recommend them to the attention of the advocates of this new doctrine.

Sulphur.

There is no other element so widely distributed in the animal, vegetable, and mineral kingdoms as sulphur. Nature employs it in most of her operations. She presents it under many forms among fossils; charges with it the waters known as sulphurous; mineralizes with it most of the metals forming iron pyrites, galena, cinnabar, blende, and silver glance; causes it to pass into the vegetable and animal fibres, and forms an infinite number of combinations with the earths. Sulphur is present in horse-radish, cresses, and many other vegetables, and is a constituent of the volatile oils of mustard, garlic, and assafœtida, and of albumen and other proteids. It is always evolved, in combination with hydrogen, from animal substances during their putrefaction; and the change which silver undergoes when immersed in mustard or an egg shows the presence of sulphur, and the strong affinity it has for that metal. When taken into the system with food, or exhibited as a medicine, it penetrates to the extremities of the most minute vessels, and impregnates all the secretions. It shows a tendency to unite with mercury equally as strong as its affinity for metallic silver, for there are instances on record of persons having been subjected to mercurial medicine for a short time, and upon the outward application of sulphur ointment for a few hours, the spot where the ointment was applied became quite black. This was occasioned by the mercury exuding through the pores of the

skin to unite with the sulphur, in consequence of its affinity for that substance, and a true ethiops-mineral was formed. A beautiful illustration of this principle is shown in one process of parting gold and silver: The silver being in excess, the two metals are melted and rolled into thin plates; then a layer of sulphur and a plate are alternately disposed, whereupon the sulphur unites with the silver, forming a sulphuret of silver in the form of a black powder, which is washed out, leaving the gold in a spongy condition, but pure. Sulphur does not unite with metallic gold or platinum, but it will form an auric sulphide when united with the cyanide of gold.

The constant presence of sulphur in the system, and the intense chemical energy of sulphur for silver and mercury, render these metals unfit for the purposes of saving teeth. The small amount of gold and platinum present in Fletcher's or any other alloy, gives no protection to silver or mercury from the invasion of sulphur. Sulphuret of silver and of mercury is formed in the cavity of the tooth in which an amalgam filling is placed, for the reason that the fluids in the tooth-substance convey the sulphur to the silver. Any amalgam filling removed will be found to be black where it comes in contact with tooth-substance, I care not how the amalgam may have stood the test for leakage in glass tubes before using. When we reflect on the complicated structure of a tooth, and consider the facts that a constant circulation is sustained as long as vitality remains, and that even in a dead tooth the same canals permit the fluids of the body to pass through its substance, the pleasing thought of a moisture-tight filling, that will not allow any moisture between itself and the bony walls which surround it, becomes a mere phantom. Oxygen has been accused of darkening amalgam and tin fillings on the outside. It does its share where the fillings are exposed to the atmosphere, but sulphur attacks them all over. Sulphur will sever its connection with rubber after it has been vulcanized to unite with silver, if silver is placed in contact.

Iodine.

Iodine, next to sulphur, is one of the most widely diffused of elementary bodies. It vaporizes at the ordinary temperatures; it is found in some minerals combined with mercury and silver; unites readily with the different salts, but enters into combination directly with metallic mercury, silver, tin, copper, and zinc, forming the iodides of these metals. Aside from its natural presence in the system, it is used largely as a therapeutic agent (stimulant, absorbent, emmena-

gogue, and alterative). From its known affinity for mercury, it is used in collutories for relieving mercurial sore mouth; and in cases of chronic mercurial poisoning the administration of iodine furnishes the most effective means of eliminating mercury from the system, thereby curing paralysis, neuralgia, and other symptoms of poisoning from this metal, for all soluble salts of mercury are poisonous.

Phosphorus.

This non-metallic element is widely diffused; it enters largely into combination with the oxide of calcium (lime) and magnesium in the formation of bone; and in the dentine of the human teeth the phosphate of lime and magnesia constitute 63 per cent., and in the enamel 86 per cent. Phosphorus unites readily with metallic salts, and unites slowly with metallic silver, mercury, tin, copper, and zinc, but it will not unite with metallic gold or platinum.

Chloride of Sodium.

This compound of muriatic acid and sodium, when reduced to dryness, forming the chloride of sodium, is found native in extensive beds, and enters largely into all organized bodies, and is essential to the digestion of food. A great deal has been said and written in regard to the combination of this salt with the mercury contained in an amalgam filling, forming the chloride of mercury (calomel), and the corrosive chloride of mercury (corrosive sub.). I confess that I do not see how such a compound can be produced in the human mouth, for the sulphate of mercury must first be formed with sulphuric acid, then boiled to a dry powder, the salt added afterwards and the two rubbed together, and then sublimed with a gradual heat, when the vapors of perchloride of mercury arising are condensed in the cool part of the apparatus, which vapors are the chloride of mercury. A very simple or mild chloride of mercury can be formed by rubbing metallic mercury with salt, but such a combination would be mechanical, and, I think, harmless. If, however, the sulphuret of mercury had formed around large amalgam fillings, and had combined with the salt in the system, or with that taken into the mouth, there would certainly be produced a chloride of mercury of a very mild character; as all soluble salts of mercury are poisonous, and it being a well-established fact that some persons are more susceptible to the influence of mercury than others, if there were no other reasons for discarding the use of this metal in the mouth, then the

fear of this combination alone should be sufficient to throw it out from the list of filling materials.

In the selection of filling materials, to secure a good result it is indispensable that the filling should fit the walls of the cavity perfectly, and that it should exclude completely all those external agencies which induce decay; that it should be solid and undivided in all its parts, fitting it to resist all pressure likely to be brought to bear against it; and, finally, that it should resist to the fullest extent chemical action, thermal influence, and attrition.

So long as we are confined to the use of metals for filling material, there is no metal or combination of metals or substances that has yet been found that can take the place of gold for that purpose. It possesses more of the valuable properties of the force of cohesion (hardness, elasticity, malleability, ductility, etc.) than any other metal; it is capable of receiving and retaining additional powers of cohesion by the application of coercive force; and when combined with small quantities of its sister-metal, platinum, its hardness and elasticity are greatly enhanced by the joint action of adhesion and cohesion; in fact, the attraction of cohesion in gold is so powerful, that at ordinary temperatures it will unite under coercive force almost equally as well as iron or platinum under the influence of heat. Like platinum, it is not influenced by any single acid or alkali; it does not tarnish in moist or dry atmosphere at any temperature, and it is not affected by sulphur, iodine, or phosphorus.

Cohesion of Amalgams.

All metals lose their natural coherence when alloyed, and when amalgamated with mercury the standard of cohesion is further reduced. Silver and mercury do not oxidize in the atmosphere at ordinary temperatures, but when the silver is amalgamated with mercury the silver oxidizes, owing to its having lost much of its cohesive force. Platinum and mercury do not unite,—the hardest metal to fuse and the metal which is in a fused state at ordinary temperature have no sympathy for each other. Copper will not unite with mercury, but will unite with the nitrate of mercury, and the combination will then receive additional quantities of the metal mercury.

On contact, gold and tin, either separately or combined, unite with mercury perfectly, and give up their cohesive properties in their combination with the mercury; for this reason the amalgam

does not harden, and the gold and tin lose all their individuality in the combination.

Silver and zinc, either separately or combined, unite readily with mercury; they lose much of their cohesive force, expand in hardening, destroying the fluidity of the mercury, and losing all their own peculiar properties.

Expansion and Contraction of Metals.

The superficial expansion of a metal is equal to twice its linear expansion, and the cubical expansion to three times the linear. The metals used by the dental profession are the following, the most expansible standing first in order: mercury, zinc, tin, silver, copper, gold, platinum.

Mercury is so expansible that it is classed among the liquids, and vapor arises from it even at the freezing-point of water in sufficient quantity to whiten gold-leaf; the temperature of the human body (98° F.) is sufficient to overcome the whole of its cohesive force. Thus mercury, tin, and silver, forming nearly the whole body of amalgam fillings, must be measured by their cubical expansion under the influence of heat, and a corresponding contraction under the influence of cold.

Conduction.

The thermal conductivity of the metals in use stands in the following order as regards their thermal conductivity: silver, copper, gold, tin, and platinum. Mercury is so poor a conductor that heat vaporizes it at ordinary temperature.

New and original research requires a singular independence of mind, and, unfortunately for the cause of progress, such minds are at all times rare. The electro-chemical theory for the destruction of tooth-substance in contact with gold only lacks the facts to sustain it, but when men need facts to sustain a favorite or plausible theory, they are not long in seeing the facts required; everything becomes clear in the uncertainty; a little experiment, a little straining of the eyes, and all is seen that they believe they ought to see. And thus they sail on an unknown ocean, trusting to hypothetical charts, to compasses of their own invention, in which the essential feature is the omission of that magnet which can alone give security.

Yet for ages this has been the only seamanship deemed necessary or practical in the history of medicine and its many specialties. And how many still trust to it implicitly! Thanks to the inroads that

physical science has made on our domain, the dawn of a better day is fast approaching, and the next generation must witness disclosures not less startling than those which have electrified the present day. In the mean time what we want is a careful classification of existing facts (physics, not metaphysics), their exact relation to each other, the great aim being to discover a genuine sequence of phenomena traced link by link to a definite cause.

The opinions advanced by Professors Flagg and Chase, and Dr. Palmer, are acquiesced in, either actively or passively, by many of those with whom they are working, as well as by others who are but slightly acquainted with the subject themselves, but who very naturally look up to the professors in their scientific character as authorities in all such matters. Were these simply theoretic opinions, they might very safely be left to the ordinary action of that silent criticism which quietly hands over to oblivion so many errors. But when we find them taken up by active, energetic men, and used as an important portion of their working machinery to increase the sale of mercurial compounds for filling material, they must be met in a formal and emphatic manner; and this becomes all the more necessary when we find them countenanced by writers in the same profession who have little, if any, monetary feeling in the matter, but who have simply been misled by superficial considerations.

Résumé.

In recapitulating some of the observations recorded in this essay, I desire to call attention to the following propositions: A voltaic battery cannot exist excepting in the manner directed by Professor Volta, the inventor or discoverer. It consists of an equal number of pieces of zinc, silver, and pasteboard; the pasteboard pieces are soaked in a solution of chloride of sodium, and then are piled with the metals in the following manner: zinc, silver, pasteboard, and so on, in the same order, the uppermost plate being of silver, and the undermost plate of zinc. These exterior plates, to each of which a wire is attached, form the terminals or poles of the pile. This was the first form of those instruments now so well known by the general name, "galvanic battery." The word battery is not applicable to any arrangement of elements present in the mouth. An electric battery is a collection of distinct cells, each cell so arranged in its elements as to secure an electric combination, and each combined cell so electrically joined to the others as to secure an unity of the whole, thus forming a battery.

The methods of construction of batteries for the generation of electricity are various and peculiar, both in regard to the material used and the arrangement. Thus we have a Smee's, a Grove's, and a Daniell's battery, each bearing the name of its inventor; and when "Dentos and Gold" shall be proved to form an electrical combination, and be proved to be a battery, *it* may also bear the name or names of the inventors.

If vapor rises from mercury at the freezing point of water in sufficient quantity to whiten gold-leaf, an amalgam filling subjected to the heat of the human body (98° F.) must gradually part with its mercury by vaporization. This can be demonstrated by selecting a few old amalgam fillings, and, after accurately weighing them, submitting them to a heat sufficient to evaporate mercury. This being done, let the mass cool and again weigh, when it will be found to weigh as much as it did before heating. As a further test of the divisibility of mercury under the influence of heat, take one hundred parts of Fletcher's alloy, add sixty parts by weight of mercury, and allow it to harden; then submit it to a sufficient heat to vaporize the mercury, and weigh the residue, and there will be found one hundred parts,—the mercury having disappeared.

Therefore, when an individual, either by bad counsel or a false economy, has been subjected to mercurial or amalgam treatment for diseased teeth, we find that fifty parts of the mercury out of the sixty used in forming the amalgam are vaporized by the heat of the body in a few years, and taken into the system in small but regular quantities,—the most potent manner of administering mercury for a constitutional effect. Should not this be sufficient to induce every conscientious practitioner to discard all amalgams from the list of filling materials, and be the means of inducing others to be less presumptuous in their speculations, and more honorable and resolute in their practice?

DISCUSSION.

Dr. Tucker: Very unexpectedly do I stand before you to-day, although I am very happy to meet you. I came here not with any expectation of saying a word, but some of my old friends insist upon my saying something with reference to the old system of filling teeth.

I have only to say that I am stronger now than ever before in the opinion that the old system of filling the teeth with soft gold and

hand-pressure against the walls of the cavity was the true scientific method. I have watched with great interest the changes that have come over our profession. I have had many discussions upon the subject, and at the first introduction of cohesive gold and the mallet I condemned the practice, as all the dentists of Boston know, claiming that the principle was wrong.

I admit that a more beautiful filling can be made and a better surface secured with cohesive than with soft foil, and that a tooth may be built out as desired, but that is not all that is wanted of a filling material: what is wanted is that which will best preserve the teeth. There is a circulation going on through the dentine continually, and the mistake has been made by many in supposing that by pounding cohesive gold hard against the walls they would stop the circulation through the tubuli.

In my judgment, the moment you strike the gold with your hammer you condense it and it becomes solid. You cannot spread or wedge it after you have struck it with your hammer. The principle of preserving teeth, in my judgment, lies in stopping the ends of the tubuli, and if you dam or seal up the ends of the tubes ossification will commence there at once.

In proof of this, if you fill a sensitive tooth with oxychloride of zinc or with gold, you will find, upon removing the filling after some time, that the sensitiveness has disappeared. This, in my opinion, is effected by the sealing up of the ends of the tubes, thus stopping exudation from within and preventing decay back of the gold. For decay is produced more from morbid action of the fluids back of the gold than around the orifice. As I watched teeth in my early years of practice, I did not find them decaying around the orifice, but back of the gold, the circulation from the tubes not being stopped. This fluid by chemical reaction forms a solvent which acts on the dentine, so that you will find your tooth is turning blue back of the gold.

I will say that in our old method of filling teeth our object was never to make the gold solid against the wall or on the floor of the cavity,—never,—but to press it laterally against the wall, so that the particles of soft gold would stop the tubuli, and when so pressed against the walls never to move it, for if you do it will make a failure. If the gold is packed with equal density in the cavity, then, by condensing the gold on the surface, you have made, as it were, an artificial enamel, because you have made the surface so solid that the fluids of the mouth cannot affect it. If I have made this clear to you, I am satisfied, but I repeat that in my judgment the mistake

in filling teeth at the present day is from not stopping the tubuli in a proper manner.

As you all know, I suppose, I introduced my gold in pellets, pressed them one against the other, as you would press leaves in a book, until the cavity was full; then condensed the surface, and spent a great deal of time in finishing it, making it solid and firm against the edge of the orifice, and by this method fillings were introduced forty-three or forty-four years ago that are good now.

I am sorry to say that it is said that many fillings put in lately with the mallet do not prove altogether satisfactory. The remark is made to me very often.

If there is anything in the practice of the old method that is truly scientific, it appears to me that the nearer you draw to it the better it will be for our profession.

Dr. ATKINSON: I was astonished when the paper just read was said to have been submitted to the Section and adjudged worthy of record with the secretary. Any English scholar who read the wretched platitudes and miserable verbiage of the paper, and defended it by adjudging it worthy to consume the time of this body, needs to go to school. What do you think of the "wild-wilderness" and the whole host of such abominable trash as that from a man who claims to know anything about natural philosophy, giving us such wretched, driveling misconceptions and misstatements!

This paper speaks of the possibility of a single body (aside from oxygen) being capable of producing action upon the organism; and says that vaporized mercury, as mercury, would be absorbed to the extent of fifty per cent. of an amalgam filling into the system. In the first place, you must combine the molecules of the mercury with some other agent before they have any affinity for the body at all.

One who is familiar with the old method of making looking-glasses with tin foil and mercury knows that the workman would be literally saturated with it, so that he would not be capable of handling a gold or silver watch without its becoming amalgamated, and all this, too, without his health being compromised by the mercury, so long as it remained in the metallic state.

I am in earnest about this, and think so many intelligent faces and consciences as are before me ought not to spend the time of this body with such unprofitable trash as I consider the paper to be. If this paper is valuable anywhere it is valuable in the hands of experts, who are thoroughly up to the latest apprehension of what science is, and then, if they would correct it and give us the real value that is

in it, it would occupy about one or two minutes. That is all I have to say.

Dr. BUCKINGHAM: I want to take exception to that mode of discussion which merely asserts that things are trash, without giving us any evidence that they are trash. I contend that there are scientific points in the paper just read that ought to be discussed fairly and plainly,—subjects really of as much importance to us as any others that come before us. Any man can use harsh language and denounce things in the manner in which we have just heard them denounced, but it is not right that important subjects should be treated in that way. The author has taken up the subject properly and discussed it properly.

The subjects are so deep that we are not able to get to the bottom, but the paper is much better than many that are read here. I am not able to discuss it at the present time.

The theory of most of those advocating the so-called "New Departure" is, that there is no chemical change unless there is an electric current produced. Even the decomposition of wood, or any other chemical action, is nothing but an electrical change! If you carry electricity so far as that, you have electricity in everything; no change can take place without some electrical effect.

The more you begin to study a battery, even the very simplest kind, the more difficulty you find. I venture to say there is not one man in a thousand that can explain even the simplest of them. They are exceedingly complicated, and though we observe certain results taking place we cannot trace them step by step to their source.

You recollect some years ago, when some few of the dentists in different parts of the country undertook to say that all kinds of acids were formed in the mouth. The elements are there, they said, and why not the acids? But because you have the elements it does not follow that you have the acids, because the elements do not always combine to produce them. It is a question for us to determine whether the decomposition of tooth-structure is what it is supposed to be.

I venture to say there is not one here that can tell you what decay of a tooth is. You will find as many theories about the decay of a tooth as you will find persons who undertake to describe it. The facts discussed in this paper lie at the very foundation of our principles, and they should be discussed carefully; and no essayist should be denounced in the language that has been used here until the utter fallacy of his positions has been established.

Dr. ATKINSON: It requires intelligence on the part of the listener to comprehend what is said, and individuals, unable to follow the thread of mental action of the speaker, should have the modesty not to put their lame interpretations upon it and cite it as an offense committed by the speaker.

I did say, and I leave it to every one if I did not make the point of my speech against the possibility of mercury alone having any effect upon the human body, and that it must be combined with something else before any effect was produced. Now, as to finding fault with the study of the depths of the science, I am the last man to do that.

The point is this: that we need to discriminate between the things that we fancy and the things that we know.

I do say that I had a perfect right to characterize that paper from my stand-point, and assert my objections and how it impressed me, and I hold I did it justly and honestly, and for the love I bear to this body and to the truth, and persons not capable of feeling that love should have the modesty not to say unkind things.

The last speaker says there is not a man here that can define decay. I will define decay for him: *de*, down, and *cado*, I fall, I fall down,—falling apart. There are two ways of falling apart, especially of the constituents of the human body. One is by a regular retrograde metamorphosis of going down the constructive ladder. Old John Hunter said by an inspiration, two hundred years ago, that "Inflammation is nothing other than the return of the tissues to the embryonic condition." Now I have told you what decay is. When inflammation seizes the tooth-structure, it acts by that progress of retrogressive molecular metamorphosis, and dissolves by simply taking out the lime-salts, in the first place, and then tumbling to pieces chemically, by expelling one constituent after another until destruction is complete.

That is decay ordinarily. There is another degree of decay that is also chemical, effected by applying an acid or alkali that holds a greater affinity for some one of the elements of tooth-substance than these hold for each other. This is chemical solution (decay) *par excellence!*

Dr. ALLPORT: Dr. Atkinson has spoken about the action of mercury and its combination with other substances. I would like to ask him what that combination is, what change it is that takes place, and the effects produced upon the system by the use of mercury as referred to here?

Dr. ATKINSON: My observation is that there are only two combinations of mercury in common use that are said to be deleterious to the human body; and one only is truly poisonous, which is the bi-chloride, or corrosive sublimate. When this is used in considerable quantity, it acts very destructively upon the tissues.

Dr. BUCKINGHAM: Dr. Atkinson's explanation of decay is the most comprehensive I have heard. Every chemical change which takes place, according to his theory, is decay. Unfortunately for our language, we must have words to convey ideas, and words are not facts. Nobody will undertake to say that fire burning up wood is decay, and yet when you have the wood decomposed by oxidation and by decay the process is the same. The doctor has noticed the process by which the tissues of the tooth are broken down, and the chemical changes that take place, one element going to one side, and the other to the other. There are two forces in operation during the process of decay.

There is a vital power that protects the tissue. You destroy that vital power, and when decay sets in it is a chemical decomposition.

The action of mercury on the system cannot be explained, nor, in fact, that of any other remedy. There is no other science that is so empirical in its practice as the science of medicine.

You take the simplest element,—the mercury which may be taken into the system, and chlorine, which we take every day in common salt, and these two elements, when separate, have little action on the body, and yet when you combine them they make a most poisonous agent. How do you explain this? How do you explain any of these actions upon the system, that of morphine, of strychnine, and other poisons when taken into the system? How do they act? They produce a recognized effect, but we cannot tell how they act. If you break up the combinations, what are they? Put them in a certain form, and they become the most deadly poison. It is all empirical. We do not know anything about it, and there is no book published that gives you the action of medicine upon the system.

Dr. ALLPORT: I was very much pleased with the remarks of our old friend and father, Dr. Tucker, with regard to the use of soft—non-cohesive—gold in the filling of teeth. Most of you are aware of the ideas which I have entertained for many years upon that subject, and how much from the very first I have been opposed to the exclusive use of cohesive gold in fillings.

Of course, cohesive gold has its proper place. It is useful for covering or finishing fillings made of non-cohesive gold, and for contour

operations,—the building-up of crowns and restoring them to their original shape. The filling of a cavity and the restoration of a tooth to its original shape are entirely different operations, and require a different quality of material as well as manner of manipulation. The object in filling a tooth is to arrest decay, and this is done by such a perfect adaptation of a filling to the walls of the cavity of decay as to exclude moisture, from whatever source. The agents employed for this purpose should be such as will enable the operator to secure the result with the greatest ease and certainty. In my judgment, the preparation of gold best adapted for this purpose is non-cohesive foil, rather than cohesive gold. The working qualities of these two preparations of gold are widely different.

Two surfaces of non-cohesive gold, when placed in contact, will cohere, if at all, only by great pressure. Rolled into a ball between the fingers, the surfaces easily sliding upon and adapting themselves to each other, the mass becomes hard and unyielding only as it approaches a solid condition. A piece of highly cohesive gold treated in the same manner will weld by cohesion at separate points of irregular distances as they are brought into contact. This welding at separate points soon renders the mass angular, somewhat analogous to a bunch of burrs, clinging to each other in some portions, while separated at others.

There is a difference between a solid plug and a hard plug. A plug may become quite hard, and at the same time be full of openings, which are readily revealed by the microscope. The preparation of gold best adapted for filling teeth is possessed of a pliability and non-cohesive quality similar to kid, silk, or cotton. The surfaces of these materials, when massed and rolled between the fingers, readily slide upon each other, and become hard only as they approach their smallest possible dimensions. A filling, in order to save a tooth, should be a perfect cork and prevent the passage of fluids between it and the walls of the cavity, as a cork prevents the passage of fluids between itself and the nozzle of the bottle. Great labor and care may make a perfect glass stopper, but, owing to its hard and unyielding character, unless fitted with great exactness, it will be useless. The readiness with which the common wood cork can be adapted to uneven surfaces renders it much more available, therefore, for this purpose than the unyielding glass. Cohesive gold as a material for filling teeth is analogous to glass as a stopper. That, with great care and extraordinary skill, good fillings may be made with cohesive gold, there is not a doubt. But that a large majority of fillings made

with it by ordinary dentists are imperfect and comparatively useless will not be denied by any careful observer. The great pliability of non-cohesive gold, and the ease and certainty with which it may be forced into fissures and irregular angles of cavities without clogging or choking, enables the average operator to obtain much better results than can be secured by the use of cohesive gold. The material to be recommended for general use is not that which great skill only can make serviceable, but that which the ordinary or average skill of the profession can make the most useful in the saving of teeth. That the average skill of the profession will be more successful in ordinary operations in saving teeth with non-cohesive than with cohesive gold, I have not a doubt. For this reason non-cohesive gold foil should be recommended and adopted for general use. Dentists of twenty and thirty years ago did not attempt the more difficult class of operations that are successfully performed by our skilled operators of to-day. Their operations were confined to the simpler kind of cavities, and little attempt was made at the restoration of the shape of teeth, —what is known as contour work. The class of cavities then filled with non-cohesive gold by the skilled operators of that time, compared with the same class of operations made with cohesive gold by our average college graduates of to-day, will show a greater percentage of teeth saved by the old-fashioned method than have been saved for the last twenty years by the use of cohesive gold. While these old fillings may have rough and uneven surfaces, the teeth will be clear and free from that blue appearance indicative of decay, so frequently met with at the present day.

These modern dentists succeed in making hard and very beautiful fillings, but it too frequently happens that what at first seem to be splendid successes in a few years prove to be lamentable failures.

Around these fillings the teeth in a few months present a suspicious appearance; later on they begin to turn blue, indicating decay, growing darker and still darker until finally the walls give way. The hard and beautifully polished filling falls out, and the tooth is lost. We frequently find fillings, put in by these old-fashioned operators with ropes of non-cohesive gold, so soft that they can be readily penetrated with a plugger or lifted out with an excavator, the ropes easily uncoiling after removal. Still, around these fillings the teeth present a clear and healthy appearance, without the least indication of decay. I have seen hundreds of these cases, and I doubt not Dr. Morgan, Atkinson, and others of our old operators have seen as many. Now, why is it that these rough fillings, so soft that they can be readily

penetrated with a plugger or removed with an excavator, had so long saved the teeth, while the hard and beautiful fillings of cohesive gold so frequently fail to accomplish this object? Simply because the great pliability of the material enabled the operator, without great labor or force, to so adapt it to the walls of the cavity as to exclude moisture. For these reasons cohesive gold in the hands of the average operator cannot be too strongly condemned for general use in filling cavities of decay, so long as we have in non-cohesive gold a working quality that would render their operations far more certain of success; that, too, with far less labor than is now expended on cohesive-gold fillings. For the finishing of fillings and the building-up of crowns, cohesive gold is invaluable; and, as a rule, its use should be limited to these operations. Should the profession at large adopt this mode of practice,—namely, non-cohesive gold mainly for the body of their fillings, and cohesive gold for surfaces and the restoration of the shape of teeth,—the general results would be far better than are now attained.

Dr. MORGAN: I would like the doctor to give us his idea of a perfect filling in all its points,—a large filling on the grinding surface of a molar.

Dr. ALLPORT: You mean an ideally perfect filling?

Dr. MORGAN: Yes, sir, according to your mode.

Dr. ALLPORT: You mean a filling that will subserve the purpose of saving teeth?

Dr. MORGAN: No; I mean a perfect filling. You were talking about making a perfect filling. I want to get at what you mean when you say a perfect filling.

Dr. ALLPORT: When I say a perfect filling, I mean a filling that will save a tooth the longest.

Dr. MORGAN: What sort of a filling is that? What is its condition? what are the factors in the case?

Dr. ALLPORT: The essential factor is that the gold shall lie in absolute contact with the surrounding tooth, the rest is mainly superfluous; and this result can best be obtained with non-cohesive gold. The liability of cohesive gold to draw from the walls of the cavity, and ball up under direct pressure from the instrument, renders it necessary for most operators to make retaining-points at different places in the cavity, in order to keep the gold from tilting or loosening in the tooth. This tilting is caused by a lack of a perfect adaptation to the cavity, and when tilting has once occurred, no matter how many retaining-points may be made, moisture will penetrate

between the plug and the tooth. It is not necessary that the filling should be like molten gold. On the contrary, I believe that if the filling perfectly fits the cavity, it makes but little difference whether the main part of it is hard or soft, so long as its surface is hard enough to resist friction and retain its integrity of finish. In fact, a filling of medium hardness, so long as it meets these conditions, is less liable to undue thermal changes and more compatible with the health of the tooth.

Dr. BARKER: I would like to know if the doctor would advocate the use of soft foil in cavities that have not four good walls, and if his method of using soft foil is in the form of cylinders?

Dr. ALLPORT: I use it everywhere until I get near the surface. I then use freshly-annealed cohesive gold for finishing the filling or restoring the shape of the tooth.

A MEMBER: Suppose you had a definite retaining-point, can you build right on to that?

Dr. ALLPORT: I can, generally. Cohesive gold is the most deceptive thing in the world in filling teeth. Its use requires a retaining-point to keep it from tilting in the cavity. It frequently happens that after the gold has been moored at this point, a blow a sixth or an eighth of an inch from its anchorage will loosen it from its fastening, showing conclusively that the gold has curled up under pressure from the instrument and that it rocks because it does not fit the cavity. To obviate this rocking, or to keep the gold in the cavity after it *has* rocked, dentists frequently make several of these points. But non-cohesive gold fits so perfectly to the cavity that retaining-points are less essential.

Dr. DICKERMAN: Do you use non-cohesive foil in the form of cylinders?

Dr. ALLPORT: If there is a cylinder to be filled there is no objection to the use of a cylinder with which to fill it. I formerly used them a great deal, but do not of late years. I use my gold by tearing it in pieces and rolling it in pellets between my fingers, and as I proceed with my operation use large or small pellets, as the case may require. If the cavity is of irregular shape I succeed better in this way than with cylinders.

Dr. MORGAN: The doctor makes a point that I wish to enter my protest against. He is frank enough to say he does not know how to pack cohesive gold, and with it fill a cavity perfectly,—how to get the gold against the walls so as to exclude the moisture from the cavity,—and he assumes, because he does not know how to do it,

that nobody else does. I was taught when I was a young man to use soft foil, and I use it yet to a very considerable extent, but I can assure him, upon the honor of a man, that I can take cohesive gold and fill a cavity as perfectly as I ever could with non-cohesive gold, and I want to enter my protest against the assumption that other men cannot do what he admits he cannot. He has no right to speak for me or for any one else here. When he sees a cohesive filling with dark-blue lines around it, he sees one that has been imperfectly made, and the imperfection was due to the manipulator, not to the material, because cohesive gold is susceptible of being put where any other form of gold can be successfully placed.

I know a good filling can be made with non-cohesive gold. I asked him for his ideal of a perfect filling, but I did not get a direct answer.

Dr. ALLPORT: There is not a perfect filling in the world.

Dr. MORGAN: You used the word perfection a number of times, if you will excuse me for being so personal. I understand that no man ever made a perfect filling, in the best sense of that term, but we all have an ideal of a perfect operation, and that is one in which the cavity shall be so shaped that it will retain the gold, that there shall be no decay left in the cavity, and then that it shall be perfectly filled with gold, and that the gold shall be in one solid mass when the operation is complete.

That is the ideal. The nearer we approach to that the better filling we have. If it is soft enough to put an excavator through it to the bottom, it is a very imperfect filling; and while some of them may preserve teeth under certain circumstances for thirty or forty years, a very large majority will drop out in a much shorter time. He said of teeth that were well filled forty years ago that the fillings in the majority of cases are now standing.

That is also an assumption that he cannot demonstrate, and it is one that no man's observation will justify him in making,—if he intended to convey that idea. The truth is, that a very large class of teeth that are filled and preserved with cohesive gold, at the present time, were not touched by our best operators thirty years ago. I know whereof I speak, because I was familiar with the operations of the best men in the profession of that day, and I know that from one-fifth to one-fourth of the operations now made by men who make what I consider first-class fillings, are upon a class of teeth that were not touched by any of those gentlemen.

I know the fact because I have been in many places and examined the patients of our best operators of the present time, and I also

know what a number of the very best men in the United States did in former years.

Dr. FILLEBROWN: I wish to enter a protest against the assumption that to use cohesive gold successfully it must necessarily be malleted. Such is not the fact. I know of more than one operator who uses cohesive gold habitually, who does not use the mallet for one-twentieth of the fillings he puts in. Cohesive gold may be used with hand-pressure just as thoroughly and well as soft gold, with a great deal less pressure and much less danger of injuring the teeth.

Dr. ALLPORT: Why?

Dr. FILLEBROWN: Because it does not take so many pounds of pressure to thoroughly cohere the cohesive gold as it does to press the soft foil to place, and the less the pressure used the less danger of injuring the thin wall of a cavity. In using cohesive gold there is no necessity of drilling retaining-pits; it can be held to one part of the cavity while it is being built across and supported against the opposite walls, just as readily as soft gold can be. I am one of those who do not pretend to use soft gold as skillfully as some who have used it many years. But I know cohesive gold can be used just as successfully as soft gold. And while it requires twelve to fifteen pounds' pressure to condense a soft-foil filling, three or four pounds is ample to make a perfect cohesive plug. Properly prepared, it is so malleable it will go home to its place not only by laying one lamina upon another, as soft gold will; but it can be moulded to the cavity by change of form just as a piece of Fletcher's cement can be. When cohesive gold can be used to such perfection and success, we should use it. I know of cohesive fillings that have remained twelve and fifteen years without change of color, and every way perfect so far as could be observed. This is just as good evidence that cohesive gold is a good material for filling teeth, as that soft gold is a good filling because some teeth have been preserved so many years by fillings very imperfect in the beginning.

Dr. THOMAS: No two men have the same perceptive faculties, no two men will fill a tooth alike, and at the same time we are all aiming to produce like results. No two physicians in the treatment of disease will treat just alike. If they do, it is a coincidence.

It seems to me that the practice of entering protests against any man's mode of operation is folly. I, like Dr. Fillebrown, do not pretend to be a skillful manipulator of non-cohesive foil, because I was not educated in that school. I came into the practice of dentistry about eighteen years ago, and at that time we were just entering

upon the use of *co*hesive foil—and the dental profession, when they take hold of anything, it is with a *vim*—and it seems to me now, in looking back over that length of time, that when the dental profession took hold of cohesive foil, they left out of sight *altogether* the use of non-cohesive foil; they ran wild over the subject, and they have run wild over a great many things since then.

I can see men sitting before me who ten years ago at least used nothing less than No. 20 foil; some went as high as Nos. 240 and 260,—made all their fillings chiefly of that kind of foil.

The men are here to-day, but they do not operate in that way now. They are gradually getting back to old-time principles, as Dr. Fillebrown has expressed it, when he says the mallet need not be used with cohesive foil.

I think so, too, in the majority of cases, but Dr. Fillebrown used it more five years ago, if at all, than he does to-day, and five years ago he used a great deal more pressure, if he did not use the mallet, and he is using it less and less. I will make that assertion, that he uses it much less to-day than he did five years ago, because I believe him to be a careful, conservative, and progressive dentist.

Dr. FILLEBROWN. Say ten years ago and I will agree with you.

Dr. THOMAS: I have occasion frequently to see fillings that were made thirty and thirty-five years ago of non-cohesive foil, by a neighboring practitioner, that are saving the teeth to-day just as well as they were one year after they were made; and, as one gentleman has said, you can take an excavator and push it clear through many of these fillings.

The fillings must be leaking and at the same time the teeth are preserved. That means something. I do not advocate filling teeth in that way, but at the same time the object he sought to attain has been attained. 'Tis true, as one gentleman has said, they did not attempt to fill teeth in that day that we do in these days of modern improvements. The teeth that there was any doubt about saving were extracted. But it seems to me that there is a middle ground in this matter of gold and the way it should be prepared for filling teeth; and I think that Dr. Allport made a good point when he said that in the use of cohesive foil "the more you work it the harder it becomes." It becomes, as it were, a bunch of burrs, stiff and hard, and it draws away from the margin of the cavity the more you work it, unless you put upon it that very fine work that few men can do without encountering the liability of fracturing and checking the enamel walls of the cavity. And this is a point I wish

to make conspicuous,—the liability of fracturing the walls of the cavity by the force (mallet or otherwise) that is often necessary to put cohesive foil where you want it.

When you put your gold plate between the dies to swage it, you heat it to make it as soft as possible, but just as soon as you strike it, it becomes harder, and the more you strike the harder it becomes, and in its hardened condition, under your hammer it springs, curls, and twists. But, fortunately, the way out of the difficulty is easy: re-anneal it, place it between the dies, and give it a gentle tap or two, and it yields gracefully. In the use of cohesive gold the pressure or force used should be just as light as possible to produce the desired results.

The working of gold is not unlike the management of individuals: persuasion conquers where coercion fails.

We all know that there is such a thing as filling a tooth in what we call a perfect manner with cohesive foil, but there are such a variety of cavities, such a variety of instruments, and such a variety of men, their way of manipulating is so different, that it is very seldom that a filling is what we would call an ideal one, made of any kind of gold. Let us not, in our desire to make beautiful fillings, lose sight of the fact that the *tooth* should be our *ideal*, and not the filling. With the use of cohesive foil we were taught that retaining-points were necessary to make the filling retain its place, but it is very seldom that I now use a retaining-point. If I can't make a filling without a retaining-point I am pretty sure I am making a poor filling, and I think that cohesive gold is very deceptive, and its use in the hands of young operators I believe is productive of a great deal of mischief. I believe a young operator ought to be taught to use non-cohesive gold first. If a man can use non-cohesive gold, you may put cohesive gold into his hands and he will do a great deal better service with it than he could do without the knowledge of the working properties of non-cohesive gold.

Cohesive gold, under force, will draw towards the centre of itself. In many proximal cavities where the walls are frail, the pressure required to put the gold in proper place is liable to injure the walls of the cavity, and if we were to examine with a microscope many of the enamel walls which appear, after the filling is completed, perfect to the naked eye, we should find that the enamel is full of checks produced by the action of the mallet.

It is true you may take a simple cavity in a molar, a cylinder, as some gentleman has expressed it, and you may pack your gold, using

as high a number as 240, putting on great force with the mallet, and when you have got through you will have a good plug; you can risk it there, but you cannot risk it in marginal walls, where you need to exercise the greatest care, and where non-cohesive gold should be used.

Cohesive gold is softer than non-cohesive. It is not because it is so hard that we cannot use it easily, but because just as quick as one crystal touches another crystal it will adhere and curve, curl and twist, and that is where the trouble begins. If we should teach young students the use of non-cohesive gold first, they would not have so much trouble with fillings leaking around the margin.

Dr. TAFT: In discussion of the subjects presented for consideration before this body, it would be well if special pleading could be avoided, and the ascertainment of the truth be made the chief aim. There are different opinions and shades of opinion upon almost every subject held by different individuals, and the subject before us is not an exception in this respect.

Still, it is a matter of surprise that men who have been in dental practice for twenty years and more, and for most of that time actively prominent, should say that cohesive gold *cannot* be adapted to the walls of an ordinary cavity sufficiently well to exclude decay-producing agents. If in this statement the ability of the speaker only is intended, it may not call forth a denial. But if all are included, an earnest dissent must be recorded.

Dr. Morgan has just well said, "I will not allow any man to say what I can or cannot do in that respect; he may speak for himself: I claim the same privilege."

Experience shows me conclusively that ordinary cohesive gold, in good condition, can be as perfectly and as easily adapted to the walls of cavities as non-cohesive.

Dr. GODDARD: By you!

Dr. TAFT: Yes, and by a great many other dentists. I know it can be done, and that it is done by many operators every day.

It was stated here a while ago that men were in the habit a few years ago of using No. 220 in common practice. I have not known of such practice, though I know that some experiments were made with gold of that thickness. I know, however, that a great many use foil of Nos. 20, 30, 40, and 60. Some of the best operators in the world use No. 60 foil, and scarcely anything else. I see the operations of these men frequently, and they will stand the test with any other fillings that are made anywhere or by anybody, or any soft-foil fillings that were ever made.

Many of these fillings of heavy foil, too, are put in places where soft foil could not be used, and have saved teeth that soft foil never could have saved. I will accord to soft foil all that belongs to it. I know that simple cavities can be filled with it so as to preserve the teeth. It was stated here to-night that fillings of soft foil that can be easily pierced with an excavator will save teeth from decay. For every case of this kind, you can find one in which decay has ceased without filling of any sort, and remained so for years. I will find one case of the latter character for every one of the former that may be presented. A great many cases of filling, perhaps a majority of those that are now attempted, are such as would have been rejected when only non-cohesive gold was used.

All the circumstances and conditions attending the two methods should be taken into account and fairly estimated, in order to arrive at just conclusions in this matter. The objections that are brought against the use of cohesive gold impress me that either the objectors have defective instruments, or that they do not know how to manipulate the gold or use the instruments. If any one has properly-formed instruments, and will use them with a moderate degree of skill and intelligence, he will not meet with the difficulty named. As to retaining-pits: what is the great objection to having an angle, pit, or depression somewhere in the cavity that will retain firmly in position the first portion or portions of gold that are put in? Why should such anchorage not be made? Have we heard any good reason against the practice? One speaker says, "You will fill up a pit and add on gold, and by and by it all breaks loose, and you lose the adaptation." I pity the man who has that experience. It shows a mistake somewhere,—a want of ability in manipulation. Very frequently it is sufficient to place gold in the cavity and hold it with the instrument in the left hand until it is fixed in place. But what is the objection to an angle, such as is sometimes made, as an anchorage point, sufficient to retain the first portion of gold firmly in position? I regard it as a very important matter. It leaves the left hand free with which to do anything else you desire about the mouth. The ordinary method of stuffing in gold and holding it with an instrument until the cavity is filled up is a faulty method of operating, as far as cohesive gold is concerned at least. With the latter it is well to have the first portion fixed in place, and to build on from that, and there is no occasion for the gold moving from its position, whether you use cohesive or non-cohesive gold, where it is first properly adapted.

I desire to correct what seems to me to be a mistake in the state-

ment made by Dr. Fillebrown. He stated that with less hand-pressure cohesive gold could be better consolidated than non-cohesive. He did not state, however, that ordinarily with non-cohesive gold a far larger mass is placed under the point of the instrument than when cohesive gold is used. If the same amount of material is placed under the instrument, I do not conceive that there would be very much difference in the amount of force required to condense the two kinds of gold. Now, as to the gold "burring up" and getting into the shape referred to by Dr. Thomas. What does he mean by "burring up"? Does he mean that gold having been stuffed into a cavity rolls up into a ball when the attempt is made to consolidate it by direct pressure towards the bottom? I do not believe he gets that result when he uses good cohesive gold. But bear in mind that cohesive gold is a very different thing now from what it was at one time, or from what some preparations of it were at one time. I have seen gold so harsh and hard that it was very difficult to manipulate; but with the best forms of gold of this kind now there is no difficulty. I use non-cohesive gold, I use everything and anything that is best adapted to the case.

It frequently occurs that cases of early operators are presented where teeth were saved by the use of non-cohesive gold. I have seen—see them frequently. They do exist. We all concede that. What of it? A great many teeth have not been filled that were decayed twenty-five or thirty years ago. The progress of decay was arrested at that time, and they have remained without apparent change since. This result was brought about by an improved condition of the mouth.

The idea would seem to be conveyed by the discussion that in a majority of teeth filled with cohesive gold, very soon—in a few years at least—defects occur, dark shades appear around the fillings, and decay is the common result; that this is the rule in cases of teeth filled with this form of gold. I do not find it so. If you say you have occasionally found cases so, I will admit that, of course. But that it is the rule, I deny.

Dr. THOMAS: The doctor wanted to know what I meant by gold rolling up and having a burred appearance. If you will take two pieces of gold that are cohesive, and put them together and put them in the palm of your hand, and roll them about carefully, you will get (with a fine sense of touch in your fingers) a roughened appearance. The more you roll it the harder it will be, and the more little prominences there will appear on the surface of that gold. Is not that so?

Dr. TAFT: I do not know.

Dr. THOMAS: I know it is, and the more you attempt to separate that gold the more it will assume that burr-like shape; but the crystals of non-cohesive foil do not burr, and when you attempt to separate the mass it can easily be done. Besides, the more you roll it in your hands the smoother it becomes. The point I intended to make was, that owing to this property of burring up, cohesive foil does not perfectly seal up the ends of the tubuli.

I was gratified to-day to hear that old gentleman who has been in the practice of dentistry fifty years give us such a clear explanation of the reason why we find so many fillings with decay around them, —viz., that the ends of the tubuli were not properly sealed up. There is where the leakage comes in. It comes in from the pulp, from the inner part of the tooth, and when you use cohesive gold there is the greatest difficulty in holding it so it will not draw towards the centre, thereby leaving the ends of the tubuli open to exude secretions from the pulp. I am not pleading for the exclusive use of non-cohesive gold,—far from it,—but for a calm and careful consideration of the best preparations of gold for the saving of human teeth.

Dr. ATKINSON: If we as a rule felt more interest in our meetings, and less disposition to scatter ourselves about, and feast ourselves in other methods, it would be better for the Association.

It has been said that all the disintegrated portion of the dentine must be removed to secure good results.

That is directly the reverse of good practice. It is directly the reverse of truth. In taking away all the disintegrated dentine you may expose, or nearly expose, a pulp.

How should we teach young men to fill? By being honest enough to let them stand over us in our best efforts upon our most-loved patients, and see just how we do it, and not send them unprepared to get a "D.D.S." or any other cabalistic nonsense attached to their names, without understanding its significance.

Let them be trained by the side of the man who has been illuminated as to the principles and the practice, and let him prayerfully —yes, I mean it, *prayerfully*—ask for help that he may remove the darkness, that the pupil can see as well, if not better, than he sees the principles and the practice.

Much has been said about the materials that are used. Let me say, it is my opinion that the material has very much less to do than the knowledge of principles and the mode of manipulation. Many materials that have run well for a season have proved deleterious in

the hands of operators, eminently Fletcher's Oxyphosphate of Zinc, Weston's Oxyphosphate of Zinc, and others of the same kind. Had those who manufactured them understood the chemistry involved, or had those who used them understood it, this difficulty need not have occurred as a result of the deterioration of the specimen that worked well when first opened.

No one can fill well without inspiration, or understand it all at the first effort; hence the propriety of our examining as thoroughly as we can the conditions of the material that we use.

It has been said that almost any one can make a cavity tight on its margins. Almost nobody does. If the cavity be properly prepared, all this friable condition of the enamel that has been spoken of as being checked up by the use of the mallet or other mode of force brought to bear upon it, will be obviated. We will have no difficulty if we understand how to prepare the cavity, and I pity the man's conscience, or lack of conscience, who will allow a filler to strike an enamel edge. He is not fit to be a student of dentistry even, much less a practitioner. All the differences of view that we have result from the difference of illumination, for truth is one, and this averaging it, as some have done, I just go against as dead as I do against averaging that ten times ten is not a hundred. It is either a hundred or it is not.

Dr. MORGAN: What about tubuli pouring out their fluid?

Dr. ATKINSON: I was pained to hear men that had common sense enough to eat their dinner say that disintegration could take place without a disintegrant—that is to say, without the presence of something that holds a greater affinity for some of the elements of the tooth structure than these have for each other—when there was an absolutely sealed cavity! It is an entire misapprehension of the facts of the case; and the person who entertains that, simply needs to be warmed into common-sense views. What is the condition of a normal tooth? Every dentinal fibril is full of protoplasm as long as the pulp lives.

So short is the time, and so unwilling am I to go into the mere *finesse* of detail, that I rather desire to keep to principles, and I wish to say this: that there has been much misapprehension on the subject of transplantation and replantation of teeth that would be entirely wiped out of the minds of dentists if they would study comparative embryology and histology, by which they would get rid of a great deal of mass-generalization and jumping at conclusions, and have some square, common-sense views about what

does take place in such cases. I have seen the advocates of this kind of practice that were not fine enough in their perceptions to select a tooth that you could not distinguish as false at twenty feet from the patient, and then present it before a society as a success, with a fistula discharging by the side of the tooth where no connection had been made, and counting it as good as new. Brethren, study embryology, study histology, and when you have got those well in your minds you will comprehend pathology and therapia.

Dr. FRIEDRICHS: There is one point in the discussion of this subject that, in my estimation, has been entirely overlooked. To gold and its proper manipulation has been given, without exception, the credit of preserving the teeth after a lesion has once occurred, leaving out altogether the important action that the inherent forces of nature set up, the moment the life of this organ is endangered, to counteract destructive tendencies. We know, and I can bring authority to sustain my assertion, that whenever a tooth is attacked by caries, calcification of the dentinal tubuli ensues, and in many cases succeeds in arresting the further progress of decay. Magitot calls this "dry caries." This condition, whenever brought about, offers a better protection, as it is nature's cure, than a filling of gold can possibly effect. Now the query arises as to the cases cited by members of this Association of fillings of gold through which an excavator could be run with ease, and which could be picked out without much effort, and which have stood the test for forty years, whether or not there were other causes to which might be attributed the arrest of the decay beside the mere filling up of the cavity? For it must be granted that the material employed for filling must be, to all intents and purposes, unchangeable by the fluids secreted in the mouth; secondly, it must be impermeable to the fluids, as well as to other substances that are brought in contact with it in this cavity. Therefore I cannot, having these facts before me, realize how a filling, such as those represented in the cases cited (that we must suppose to have been permeable by the fluids of the oral cavity), unaided by the inherent forces of nature, could have been the only factor in the arrest of the progress of decay. Soft foil, or no soft foil, it is my opinion that the vital force had a share in it. I was under the impression that this gold-foil question had been settled to the satisfaction of every member of this Association, and for this reason, that it has been, and is daily, demonstrated before our eyes that teeth are equally as well preserved, whether the material employed is in the form of crystal gold, of cohesive or of non-cohesive gold foil. We must then conclude

that it is not any inherent quality in the gold itself which insures success,—rather the skill with which it is manipulated.

Dr. BENJAMIN LORD: I think that is the thing in a nut-shell. It is not the kind of gold, to a very great extent, but, as one has said, it is the power behind it.

None of us question but that teeth can be filled with cohesive gold, and filled so as to be well preserved, and none of us question but that teeth were filled, long before cohesive gold was introduced, with soft or non-cohesive gold, and were well preserved. Hence it must follow that it is not so much owing to the inherent quality of either that the required result is reached as it is to the proper handling of the material, the manipulation. The great and important question is, which can be used to the best advantage; which can be used with the greatest simplicity and certainty; which can be most readily and surely adapted to the walls of the cavity, and be made sufficiently solid to exclude moisture and all agents that would cause decay around the filling.

I firmly believe that soft or non-cohesive gold has the advantage in all simple cavities,—cavities having four walls,—and very often in cavities of three walls.

Of course, if we are to make contour fillings, or if we wish to extend the metal beyond the edges of the cavity, we must use cohesive gold, either wholly or in conjunction with soft gold.

But in all plain, simple cavities, as I said, I do not think there can be any question but that soft gold should have the preference, and for philosophical reasons. It is more plastic, not, perhaps, as we begin to manipulate it, but its plasticity is maintained as it is placed and packed in the cavity, whereas cohesive gold becomes hard and unyielding at once as we begin to work it. While I am aware that some who use this kind of gold make most excellent operations, yet my long experience and observation convince me that the great majority of dentists do not and cannot use it with the success that they would non-cohesive.

It has been said at this meeting by two of the advocates of cohesive gold, that when we see teeth that have been preserved by the use of non-cohesive for from twenty to forty years, those teeth would not have required filling at all. I think that assumption is not warranted, nor is it any argument in the case. Suppose cohesive gold had been used, would the same teeth have required filling or have done any better, or would the results have been any different?

Dr. STOCKTON: If I were a student of dentistry, and had come to the American Dental Association, as the great light of dentistry, to learn how to fill a tooth, I think that I should go home not knowing much more than I did before I came, because of the many different methods advocated. Some gentlemen who were educated to use soft foil, in attempting to use cohesive foil make a failure of it. Others, who were educated in the use of cohesive foil, having been persuaded that soft foil is better, in attempting to use that make a failure. I think we should know how to use them both. I believe that teeth can be saved sometimes with soft foil that cannot possibly be saved with cohesive foil, and I believe that teeth can be saved with cohesive foil that cannot possibly be preserved with soft foil.

A gentleman said to me, last night, that soft foil breaks up under his instrument. This would indicate that he does not know anything about using soft foil. I was first taught to use soft foil, but I would not like to be confined exclusively to its use. I believe they both have their uses, and that they both can be employed successfully in the *same* operation.

Some think that cohesive foil cannot be united to soft. I do not think that is true.

Some as good fillings as I have ever seen, in teeth that are being preserved, were made largely with soft foil and finished with cohesive.

I have in my mind now a case that came from a city in the West. The operator is one of the best, and yet the fillings, which had been made with cohesive foil, had failed. The teeth were afterwards filled by another gentleman from the same city, and in about one-third of the time, with soft foil, capped with cohesive, and, if I am any judge of fillings, and am able to forecast their future, I think that those teeth will be preserved.

The time expended in doing the work has a great deal to do with this matter of filling large cavities. With two sheets of No. 5 non-cohesive foil, where you have four good walls, you can fill a tooth in one-third of the time that you can do it with cohesive foil alone, and make the operation just as successful.

There is another point I wish to mention, which was referred to in the paper which, I think, was read yesterday. There is a great deal of fault found with the prices we charge. I think dentists are a good deal at fault there. If we would sustain one another better than we do there would be less fault found by our patients.

I think that we should do everything that we can to encourage the saving of teeth.

I was present some time ago at an association, where a gentleman said it was a blessed thing to get rid of our teeth; it was going through torture to have our teeth filled, and it was better to have them extracted with the aid of an anæsthetic, and then replaced with a good set of artificial ones.

I do not believe in such nonsense. I believe God gave us these organs, and I believe we are his co-laborers and co-workers by saving that which he has given us, and let us do all we can to save the teeth that are entrusted to our care.

Dr. Cook: We hear gentlemen say a great deal about saving teeth; that some forms of gold will save under proper manipulation, and that other forms will not. From what cause do fillings fail? Is it from leakage or from new decay starting around their borders? As beautiful fillings as I have had the pleasure of seeing I have found undermined by new decay. This was not the fault of the operator, it was the fault of the patient in not keeping the spaces cleansed. Decay, having once attacked a tooth at a certain point, is likely to occur again in that vicinity, unless other means than mere filling are employed to prevent it, no matter how carefully the operation may have been performed. The general fact that decay is liable to occur around the best fillings in many cases has been often stated, and as often admitted, by our best operators. The cause of such decay has not, it would seem, received that attention in our discussions its importance merits.

One word in relation to discussing the question of fees in our dental associations. It is not, so far as I am aware, a subject for discussion in medical societies. I am not informed that artists are in the habit of discussing this question of "fees" at their meetings. If one can do a thing properly, and certainly if he excels, he will have sufficiently appreciative admirers, with purses deep and well filled, willing to give him all his merits deserve. I think it is not a proper subject for discussion here.

Dr. Allport: As this discussion seems to be in part based upon remarks that I made last evening, I will say that speakers assume to put words in my mouth that I never uttered, expressing sentiments that I never entertained,—namely, that good fillings can only be put in with non-cohesive gold. I said distinctly that our most skilled operators could put in good fillings with cohesive gold, but that the average skill of the profession was not up to that standard; that for filling the cavity of decay non-cohesive foil could be used with greater certainty of success; for restoring teeth—building up crowns

—of course cohesive gold must take the preference. In discussing this question please bear that in mind.

Dr. WEBB: The success of an operation depends more on the ability of the operator than on the material used or the means employed. Cavities of decay may be divided into three classes: those in the grinding surfaces or in the fissures of bicuspids and molars, those in the buccal or labial surfaces, and those in the proximate surfaces of the teeth. In deep-seated cavities, or in those cases where the pulp is nearly or quite exposed, some discolored dentine should be left for the protection of this tissue, and in all these cases carbolic acid ought to be placed in the cavity to disinfect the carious dentine and coagulate the protoplasm weeping from the fibres of living matter in the exposed dentinal canaliculi. After this has been done, oxychloride of zinc should be placed in the cavity to act as a non-conductor of thermal currents after the gold filling has been inserted. Not only should oxychloride of zinc be used for that purpose, but quite a portion of each large cavity in the crown of a molar had best be filled in that way. It is far better to do this than to endeavor to so place cylinders and pellets as to get close contact with the walls of the cavity. After filling such a cavity up to near the inner surface or first layer of the prisms of the enamel, or, in other words, covering the whole or nearly all the dentine with oxychloride of zinc, enough of this preparation should be so cut away after it has hardened as to get proper and sufficient anchorage for the gold.

I am speaking now more particularly of crown cavities. A starting-point should then be made, if one of the fissures will not serve the same purpose. I do not approve the practice of making so-called retaining-points to hold the filling in place, but a point to start the filling in ought to be made in all cases, so that as the pieces of gold are put in position they may remain just where they are placed. Not a single piece of gold should move. If movement of gold takes place after it is put in position, whether that gold be the so-called soft foil or any other kind, the operation cannot but be imperfect in some degree. It has been stated that fillings can be inserted in less time and with less effort with soft foil than with cohesive gold. That is not the case if cohesive foil be properly used. If large cylinders be used, there is no question but that those of so-called soft foil can be pressed against the walls of a cavity more perfectly than the same cylinders of cohesive foil, but that is not the way to use any gold. Those who speak of soft foil do not say whether they mean absolutely non-cohesive gold, or foil that becomes cohesive by annealing. All

pure gold is cohesive, and difference in purity makes difference in degree of cohesiveness. If gold is non-cohesive, there is something on its surface to make it so; such gold should not be used, even in the sulci and fissures of bicuspids and molars. There ought to be cohesion between the particles of gold, so that there may be no scaling off as the patient advances in age, and the grinding surfaces of the teeth become abraded. Heavy foil, especially Nos. 30 and 60, can be, and is being used with entire success, but neither it nor any other preparation of gold should be touched with the fingers, nor be brought in contact with moisture in any way. The teeth that were filled with soft foil thirty or forty years ago, and still remain in place, have become more dense in structure, and most such teeth would not have been lost even had such cavities as were in them not been filled. Many operations are performed to-day that were not attempted at that time; and if we examine the fillings that were carefully inserted then, and could see the operations that are properly performed now in similar cases thirty or forty years from this time, we should find that such fillings do better and look more perfect than those operations performed twenty or more years ago. Cavities within the buccal and labial surfaces should be filled in about the same manner as those in the sulci and fissures, but when the proximate surfaces are disintegrated, and particularly where parts of the enamel are broken away, there, unquestionably, cohesive foil is the only proper gold to use. In such cases, as in others, there should be some point to retain the first pieces or narrow strips of foil, and to keep them there as the grooves or anchorages are reached and filled, and the whole operation is completed. As to decay recurring about fillings in cavities in the proximate surfaces, I would say that in all those cases where calcification is imperfect, it is necessary to cut away tissue well out towards the buccal and palatal or lingual surfaces, and towards the neck of the tooth or a little beyond the margin of the gum, and so restore the contour of the parts that the margins of enamel may be free from contact with the adjoining tooth, and be kept so by the prominent portion of the gold so resting closely against, or so knuckled up to the tooth adjoining, near the masticating and buccal surfaces, that food cannot wedge between the teeth. If such an operation be well performed, and the margins made free, these edges of enamel will be kept clean by the movement of the tongue, or the washing of the fluids in the mouth; the gum protects the cervical wall, and decay cannot well recur.

Dr. Wetherbee: I wish to enter my caveat against the assertion

that cohesive foil cannot be used for the perfect filling of all cavities in the teeth where gold is indicated. It is not true that unannealed foil in the form of pellets or cylinders can be more perfectly pressed against the walls of a cavity than can cohesive foil in the hands of an operator of fair ability; nor is it true that teeth can be preserved longer by unannealed than by annealed foil. A filling made of annealed foil, if perfect, is a perfect filling; so one made of unannealed foil, if perfectly made, is a perfect filling. The object of filling teeth is to exclude all moisture.

The three-hundredth or the five-hundredth part of an inch between the filling and the walls of the cavity is fatal. The unassisted eye cannot detect so minute an imperfection, that may exist and prove the origin of future trouble. It matters not whether you fill with unannealed foil or with annealed foil, operations upon the third quality of teeth will fail in the course of time in the hands of the best operator. Why? Because the dentinal tissue is vulnerable, and is again permeated insidiously at the margin of the gold by the fluids of the mouth, and a new cavity is formed.

Advocates of unannealed foil would say that this recurrence of decay was owing to an imperfect filling because annealed foil was used. I object to any such conclusion. I have seen fillings of unannealed foil from the hands of the best operators in the United States, and have recognized in those fillings the want of a respectable accomplishment of the ends sought to be attained. I have seen fillings from some very excellent operators through which you could easily carry an excavator, and yet the teeth were not decayed. What does that prove? Simply that in those teeth the tissue was good and the fillings kept out the majority of swamp-angels, and what few were allowed to hold saturnalia there had not sufficient force to carry the day.

Now, with reference to impaction of cohesive foil. Very often the dentine at the cervical wall may be bruised or partially broken by too heavy a blow of the mallet or too heavy a pressure with the hand-packer. Whenever that is done,—and it may be done unconsciously,—you then may look for an immediate recurrence of decay.

In proximal cavities that are deep-seated I invariably use semi-annealed pellets. If there is any doubt as to my holding them in position, I make a small retaining-pit and fill with cohesive foil. To that is added at a certain time cohesive foil that is held in position with the left hand while my mallet-packer is held in the right hand, and it never moves if I have taken the precaution to build up my

retaining-pits sufficiently high. I know whether in carrying my gold up it moves or not,—I ought to know, if I do not; and then the pellet is so made that we have the gold laminated, surface lying upon surface, instead of having the ends driven down and the lamination of the gold destroyed. It is thus made tough and strong, and stands out beyond the periphery of the cavity. When the work of impaction is finished, by carrying a burnisher upon it with some annealed foil until it is burnished down thoroughly against the periphery, any chance for the ingress of the fluids of the mouth is prevented. Why? Because at the periphery the gold with heavy burnishing is slightly expanded and carried against the wall of the cavity.

Permit me to say here, not egotistically at all, I have very little trouble with teeth decaying at the cervical wall after I have filled them. I deem it proper to say that all the gold used in my practice comes to me unannealed. It is made into pellets, cylinders, or ribbons while in an unannealed state. My pellets and cylinders are semi-annealed,—*i.e.*, the surface is annealed, leaving them in the softest or best non-resistant form.

Sometimes in the third class of teeth decay at the cervical walls will recur after the most perfect filling. It cannot be denied that fillings made of crystal gold have stood twenty and twenty-five years with not a scratch upon them, so far as the margins are concerned with no appearance of decay, and with no sign of turning blue.

Gold is a very good material in an intelligent man's hands, but it must be used intelligently; the way should be kept clear, properly adapted instruments used, and then success may easily be attained. It is allowable always to use unannealed foil, if you have not the room you want for cohesive foil. It should be carried in small pieces into the places inaccessible to cohesive gold, and there packed so that every part of the cavity shall be well and thoroughly filled, the gold being impacted against the wall of the cavity. It cannot be done, say some of our leading and respected friends. With all due respect, when they shall have been instructed in the method of impaction of gold and the use of instruments, they will change their minds.

Dr. Mills: I cannot agree with the idea of Dr. Stockton that a young man could have listened to this discussion and not know what is going on. It depends upon the young man's judgment. Taking into consideration the auxiliaries that are brought to bear in regard to the salvation of teeth, I think we cannot claim that gold,

the kind of gold, nor even the ability of using it, covers the entire ground.

According to my judgment, but one man has struck the keynote of the salvation of teeth, and I am very glad to indorse what Dr. Cook has said in regard to the matter of cleanliness. I regret to see how little attention this matter has had in our Association.

Give me a man that has an earnestness in regard to the health and cleanliness of the mouth, and that man will save more teeth than the man of better ability who ignores that department. I am surprised to see so many patients as I do coming from the hands of men of ability and judgment, who show so little evidence of understanding the necessity of cleanliness. It is an exception that a patient comes into my hands that I have never seen before where I find any marks of an effort in that direction. It is the coming men that are going to take hold of this question.

I agree with Dr. Allport in what he said last night. I think I got the spirit of what he meant. I have only this fault to find with his remarks: My impression was that such remarks from a man of his ability would seem to be giving encouragement to a sort of loose, easy way of filling teeth. He denies that; but they impressed me in that way as he made them.

I do not undertake to deny that unannealed gold does not have its purposes. I have used heavy gold, and have found it a success, according to my idea of what success is. There is a mistaken idea that it is necessary to use great force in packing heavy gold. I do not disturb my patients in its use any more than other men do in using light foil. I recognize differences and individualities in men. I agree with Dr. Lord. I cannot denounce men's methods when I see good results. I have to say in closing that cleanliness is the bottom plank of success in the salvation of teeth.

Dr. Niles: As a young dentist I want to get at some facts. I have heard a great many radical statements. Some can fill teeth better with cohesive gold, and others with soft gold.

The main point to be attained, as I understand it, is to make a perfect stopping. It seems to me that it can be demonstrated, by very simple experiments, which will do this best,—cohesive or non-cohesive gold.

Let a certain number of dentists who claim that they can secure better results with non-cohesive gold fill cavities in teeth out of the mouth, and send them to a person who will immerse them in a solution of carmine for a year. Let an equal number of those who claim

the superiority of cohesive gold do the same, and send their teeth to the same person, and see which stopping will most thoroughly prevent the encroachment of this carmine water.

It seems to me in that way we can get a definite conclusion in regard to cohesive and non-cohesive gold stopping.

Filling cavities in steel and ivory and applying the same tests does not, in my opinion, meet the conditions.

Dr. WATERS: When a tooth is filled the work of the dentist is not all done; a word to the patient must be said in regard to that work, and his or her duty in caring for it, for the result of dental operations depends as much upon the patient, I think, as upon the operator.

I have been in the habit of demonstrating to my patients, by means of the microscope, how imperfectly they cleanse their teeth.

I had not been in practice more than two or three years before I felt with great force the importance of this subject.

A young man came in to have his teeth cleansed who had no idea of cleanliness, who never used a tooth-pick, nor even rinsed out his mouth. He had noticed a set of teeth that I had cleansed, and thus his attention had been called to the matter. I felt that by performing that operation I should be throwing away my time and his, and that, eventually, he would lose his teeth. I thought I could do him a better service by saying something that he would never forget,—that would shock him and arouse his pride. I said, "Young man, my friends all think I am a very kind man, and I mean to be. Now, I have many patients who are very particular, who want my fingers to smell clean and sweet, and so I have to wash and scrub them after I handle a patient's mouth. I do not keep a cow, because I might be called upon to milk her, and if I did it, it would take me too long to get rid of the bad odor. If I cleansed your teeth, it would take too much of my time to get my hands in proper condition after it; and, although I am said to be a good-hearted man, I do not pretend to be any better than God Almighty, who is said to help those who help themselves. Let me see that you have some idea of cleanliness about your mouth, and if there is anything you can't do, come to me and I will help you out."

I did not know how deeply I had struck. The young man got up, and in a very modest way begged my pardon, saying he did not mean anything out of the way, and bowed himself out. I said, "You are all right, except you are all wrong in not taking proper care of your mouth. Go to work, and do not forget what I have said." "Oh, no," he said, "I shall not forget it." I did not see him again for

twenty-five years. One day, at Newton, a man stepped up to me and said, "Would you like to look at a set of teeth?" I said, "I would; if you have a set you would like to have looked at, I will see them if you will come to my office."

He replied, "It is not worth while to do that," and opening his mouth said, "Just look in here." The crowd gathered around, curious to know what was the trouble. I looked, and saw the most beautiful set of teeth I had ever seen,—teeth perfect in form, not a discolored one in the whole set, and the gums perfectly healthy. I said to him, "My dear sir, I am *very* much obliged to you. I did not suppose there was a person in the world that had such a set of teeth as that. They are a credit to your dentist." He said, "I have not got any dentist." "Then," said I, "they are all the more credit to you." He replied, "You may well say that. I take credit for that job, and I feel proud of it. Look here: you don't think it would make your fingers stink to put them in that mouth, do you?" I said, "Oh, no; what do you mean?" He asked, "Don't you know me?" I said, "I don't know that I ever saw you before." He replied, "I never shall forget you. I went into your office twenty-five years ago to get my teeth cleaned, and that is the way you met me." And then he repeated what I had said, recalling the facts to my memory.

The point I wish to make is, that when patients come to me with what they call imperfect work I say to them: "Acids are the cause of this; your mouth is in an acid condition; the gums show it; the mucous surfaces between the teeth are dissolving away by the acid. How do you live, and on what do you live? Are you not ministering too much to your tastes?—eating pastry and a thousand and one things that you should not?"

I say, no matter how good a filling may be, if the patient does not take care of it, it is liable to fail. A poor filling will do better service with care on the patient's part than will a good filling without care.

Dr. G. H. Wilson: A great many fillings fail, perhaps, by reason of the shape of the cavity. In filling an undercut we can, by hand-pressure, do it with comparative ease, whereas if the mallet be used at this point we should probably have a failure.

We need to be careful in the shapes of our cavities with reference to the kind of filling we wish to put in. Where there is a deep undercut with strong walls, by filling the undercut with phosphate of zinc or some other plastic material we can render the cavity of such a shape that all points can be reached without difficulty.

SECTION V.

ANATOMY, PHYSIOLOGY, HISTOLOGY, MICROSCOPY, AND ETIOLOGY.

REPORT ON ANÆSTHESIA, BY W. C. BARRETT, OF THE SECTION.

ALL through the centuries of time man has been endeavoring to find some way of escape from the penalties of broken law; to avoid the pain naturally consequent upon disordered function, or the lesions produced by accident; but until the nature and action of the so-called anæsthetics became known, his efforts were futile, or at the best but incomplete.

There are a number of different states which may be induced in which, while the condition remains, patients are insensible to pain, such as coma, syncope, anæsthesia, and sleep. The first three are pathological; the last is the normal condition of recuperation and recovery of wasted neural force. All these phases or conditions depend upon the nervous supply, and are induced by normal or abnormal nerve-currents.

There are certain drugs whose office seems wholly connected with the nervous system. Of these are nervous stimulants and sedatives, and a distinct class which are denominated anæsthetics. The mysteries of nerve force or of nervous supply have never yet been bared to human knowledge. We experiment and deduce so-called laws, but those laws are not general; they have so many exceptions that at present it is impossible to say how certain of these principles effect their marvelous purpose. Of some agents we know that their action is entirely reflex, and that the nervous system is affected through certain definite organs. But there are others of which this seems not to be true, and the scientific world is now engaged in the effort to solve this mysterious problem. So far, comparatively little progress has been made, and since the day of Claude Bernard, who advanced the theory that such agents as directly affect the nervous functions do it by a coagulation more or less complete of the protoplasmic ele-

ments of nerve tissue, nothing but barren hypothesis has been advanced.

Of the various impressions which medicinal agents may exert upon nervous function, let us confine ourselves to that state called anæsthesia, as the most important to the practitioner of dentistry, only considering stimulants and sedatives as they may be incidentally connected with our subject.

Narcosis or anæsthesia may be considered as a state of paralyzation of the sensory nerves, with insensibility or complete stupor. It is the suspension of sensation, and is the effect wrought by a number of agents, the most complete and powerful of which is hydrocyanic acid. But there are certain inciting agents or conditions aside from the direct action of drugs. In warm-blooded animals anæsthesia or insensibility to external impressions is produced by cold, or the lowering of the bodily heat, and in cold-blooded animals by the raising of the temperature. We are all familiar with the effect produced upon our own members by a long exposure to a low temperature, and we are conversant with the dreaded drowsiness which benumbs the faculties of a freezing person, which renders him insensible to pain and prompts him only to lie down and sleep. The same effects are produced upon a cold-blooded animal if the temperature be unduly raised.

EXPERIMENT 1.—Place a frog in a vessel containing water of 100° F., and it soon exhibits the same inertia and desire for sleep as the freezing mammal, and in a little time becomes quite insensible. If it be now removed to cold water it speedily recovers; but if long continued in the warmer fluid it dies.

The most common agents used to produce an artificial anæsthesia are nitrous oxide gas, chloroform, sulphuric ether, and bromide of ethyl. But carbonic acid, carbonic oxide, coal gas, olefiant gas, fumes of lycopodium giganteum, aldehyde, acetone, and other gases, when inhaled, may produce a like insensibility to external impressions. As, however, they are not commonly used to induce anæsthesia, we will not now particularly consider their properties.

How do these agents produce their characteristic effects? As I have said, this is a question which has not, so far, been satisfactorily answered. But, though no one can give an undisputed demonstration of their manner of action, there are certain phenomena the consideration of which may assist us in coming to some conclusion upon the subject, and these we will examine.

Claude Bernard says that an anæsthetic is a drug which produces a direct impression on nerve tissue. Prof. Anstie says that the pecu-

liar effects are through a modified blood-supply, or by alteration of nutrition, and most modern physiologists agree with him. Which is right? It is certain that anæsthetics are amenable to that law which is universal in therapeutics,—that to produce its characteristic effect a drug must be first introduced into the system, and that the method of its diffusion is through the blood.

EXPERIMENT 2.—Expose the lumbar nerves of a frog by raising the point of the sacrum. Pass a ligature around the whole body, excluding these nerves, and then inject the posterior extremities with woorari, or strychnia, or chloroform, and it will be seen that the anterior extremities are not paralyzed or convulsed, showing that the influence is not extended through the nerves.

To produce anæsthesia it is also quite true that there must be sufficient of the agent existing in the blood at one time. Ether and chloroform are eliminated almost entirely by the pulmonary mucous membrane. If of either a much more than sufficient quantity to produce anæsthesia be slowly injected directly into an artery, the characteristic effect is not seen.

EXPERIMENT 3.—Into the peritoneal cavity of a cat was very slowly injected ʒii of Squibb's chloroform, and the animal was but little affected. At another time I quickly injected ʒi of the same, and complete narcosis ensued.

When the drug is administered slowly the immunity is due to the fact that it is eliminated before it has time to exhibit its characteristic effect. Not enough is existent in the blood at one time to induce narcosis.

The most characteristic effects of common anæsthetics are produced when their vapor is inhaled, because it is thereby most readily introduced into the blood. The immense surface (about 1400 square feet) presented in the lungs of man brings the blood in osmotic contact with so much of the vapor that the pulmonary circulation is completely charged with it, and this is carried immediately to the heart, and thus distributed to the remotest part of the system without an opportunity being given for its elimination. But if an anæsthetic agent be injected into the venous circulation, little effect is produced, because it is carried directly to the heart, and from thence through the pulmonary artery to the lungs, where it is at once eliminated, never reaching the arterioles at all.

EXPERIMENT 4.—Into the jugular vein of a cat, previously anæsthetized, inject ʒi of sulphuric ether, and the animal will soon recover from the narcosis; while if it be injected into the carotid artery, it will deepen the influence.

We may then consider it demonstrated that the drug must be existent in the *arterial* blood in sufficient quantity at one time, in order

to produce its characteristic effect. Now follows the important question: Is it simply held in solution in the serum of the blood, or is it conveyed by the corpuscles? If the answer be, in the serum, that solves the problem at once; anæsthetics manifestly are agents which produce a profound impression directly upon nervous tissue.

But microscopic and other examinations show that anæsthetics change the character of the blood-corpuscles. You are doubtless all of you aware of the effect of carbonic acid upon the blood. It makes bright arterial blood dark in color. Carbonic oxide has a directly contrary influence, and changes venous blood to a bright red. If ether be mixed with blood, it gives it a dark-purple color. It prevents its re-arterialization, and, more than this, it changes the character of the blood-corpuscle. It dissolves it, and sets free the hematine. This phenomenon is less plainly seen in blood during its circulation, but it may be discerned even there. Chloroform turns the blood a brilliant scarlet.

EXPERIMENT 5.—Add the vapor of chloroform, or ether, or carbonic acid, or carbonic oxide, to a bottle partially filled with fresh venous or arterial blood, and then agitate it, when the change in color becomes apparent. To demonstrate the fact that ether or chloroform dissolves the blood-corpuscles, place a drop of blood upon a microscope slide, add to it a few drops of the fluid and place under a half-inch objective. Ether effects a solution much more readily than does chloroform.

We see, then, that CO and CO_2 are the direct antitheses of each other in changing the color of the blood. But this difference is not more marked than is that between sulphuric ether and chloroform. Alcohol causes blood to assume a brick-red color, and air will not again arterialize it. Yet the arterialization of blood is not a physiological process, but is quite mechanical.

EXPERIMENT 6.—Procure a quantity of defibrinated blood, anæsthetize a dog, and open the thorax. Bleed him to death by opening the carotid arteries, or by severing the aorta. Quickly dissect out and sever the pulmonary vein and artery, and, charging a large syringe with the defibrinated blood, inject it into the artery until it exudes from the vein, to clear the lungs of coagulum. Remove the lungs, with a part of the trachea, into which insert the nozzle of a bellows. Charge the syringe with the defibrinated blood again, and force it through the lungs, when the stream will not be changed in color. Repeat this, directing an assistant to keep the lungs filled with air by means of the bellows, and it will be seen that the blood is now arterialized, or changed to a bright red, the same as during life. But if instead of forcing air into the lungs nitrous oxide or the vapor of ether or chloroform be substituted, definite modifications of the color are produced.

[*Note.*—My observations on this experiment are not as full or complete as I hope to make them during the coming winter.]

It is then demonstrated that anæsthetics have the power to modify the ability of the blood-corpuscle to absorb oxygen. Is it in this manner that we are to account for the physiological effects of these agents? Let us examine some other conditions which in some of their phenomena resemble anæsthesia.

During sleep, as in anæsthesia, there is primarily hyperæmia of the brain, as may be indisputably demonstrated.

EXPERIMENT 7.—Anæsthetize a healthy dog, and over one of the hemispheres of the brain make a crucial incision through the scalp. Dissect the flaps back, and trepan, using extreme caution to avoid injury to the dura mater. The flaps are now secured and the animal allowed to recover. After two days, to allow ample time for full restoration, the dura mater is exposed and the animal again anæsthetized. During the earlier phases, and exactly coincident with the chloroform excitement-stage of narcosis, there may be observed a distinct tumor of the dura mater. When anæsthesia is fully established, this is reversed, and a depression exists where had been the protrusion. When this phenomenon has been sufficiently observed, the dura mater should be carefully removed and the wound secured by means of the flaps of the scalp. After another interval the animal should be again anæsthetized, when the brain itself may be studied, and its periods of hyperæmia and anæmia carefully observed.

Asphyxia presents many phases which are not unlike those of anæsthesia, and it is essential that we be enabled to clearly understand the difference between them. It is the result of a deprivation of oxygen, and its effects are mainly manifest upon the medulla. The lungs have nothing to do with the desire of a suffocating animal for breath, nor has the blood, any further than as that affects the medulla.

EXPERIMENT 8.—A dog was anæsthetized and a bellows ligated in the trachea, so as to entirely control the supply of air. As long as the lungs were kept expanded by the bellows, it is evident that there would be no attempt at breathing on the part of the animal. An artery was now opened, and the dog bled so nearly to death that the heart almost entirely ceased acting. Notwithstanding the fact that the lungs were kept fully inflated, *the dog now gasped for breath*, because, from the lack of blood-corpuscles to convey it, the medulla was deprived of oxygen. A tube from the carotid artery of another previously anæsthetized dog was now connected with the jugular vein of the animal, and transfusion was accomplished, the regular lung inflations of normal breathing being kept up by the assistant, who worked the bellows in the trachea. When functional activity was fully re-established and sensation of the medulla re-awakened, the thorax was opened and the lungs and heart exposed. The pneumogastric nerve was now divided, the left ventricle of the heart opened, and at the same time the pul-

monary artery ligated to cut off all blood supply to the lungs. It will be seen that the heart and lungs were now both isolated, or paralyzed, yet *the dog gasped for breath.*

As long as the medulla is supplied with oxygenated blood there is no effort or struggle for breath, even though other organs may be deprived of it, but the instant that this nervous centre is left without its needed supply there is a convulsive effort to breathe.

EXPERIMENT 9.—A bitch, two or three months pregnant, was anæsthetized and the uterus opened, exposing the quarter-grown fœtuses to the air. They manifested some uneasiness, but there was no symptom of any independent existence so long as the circulation of the mother was kept up. But when the umbilicus of any fœtus was severed there were shortly afterward convulsive efforts to breathe. This was constant with five of them. The sixth was not separated until after the death of the mother and the stoppage of circulation, when this fœtus also made the same efforts for breath.

In asphyxia the blood is dark in color, and there is the same anæmic condition of the cerebrum as in anæsthesia. The states of asphyxia and of anæsthesia are then analogous in many characteristic appearances, but I shall endeavor to show that there is a wide difference in their pathology; for while one is but the deprivation of oxygen, with the consequent characteristic effects upon the medulla oblongata, the other has added the positive presence of a toxicological agent which induces an added train of symptoms. The one is the cessation of function in the anatomical elements, the other is but a partial suspension in some of them. There are the same or analogous changes in the blood-corpuscles, and yet the pathological condition is widely variant. The one is the complete absence of oxygen from the medulla, the other is the possible partial oxygenation in the tissue elements.

Here, then, are two conditions analogous in their physical manifestations, both either produced by, or attended with changes in the blood-corpuscles, yet the one is entirely inconsistent with continued functional activity, the other quite compatible with life even indefinitely prolonged. This would seem to indicate that the suspension of sensation attendant upon both was due to widely different causes. At the outset of this paper, on the authority of Snow and others, I spoke of carbonic acid as an anæsthetic. This was not a mere inadvertence, but I did not desire to draw a distinction until it became plainly apparent. We now may see that, if I am correct, the two states are not identical. In fact, their nearest resemblance is that

both are conditions of insensibility; but on the same grounds a club may be denominated an anæsthetic, for its vigorous application will induce unconsciousness. We are then ready for a new definition, and an anæsthetic may now be denominated an agent which, existing in the blood in sufficient quantities, will produce insensibility to pain and yet whose presence in such quantities is not incompatible with a continued existence. An asphyxiating agent is one which, while inducing entire unconsciousness, is incompatible with life. Now, as these two conditions are attended by the same physical symptoms, and are yet so widely variant, it would appear that they must be induced by different means. As asphyxia is demonstrably a change in the blood-corpuscle, it would seem that anæsthesia is due to some profound and specific effect produced directly by the agent itself. Herein the conclusions which I have reached are directly opposed to those of Snow, Sansom, Anstie, and most modern physiologists, who believe both asphyxia and anæsthesia to be due to a modified neural nutrition.

Let us look at the matter from another standpoint. I have spoken of the changes wrought in the hue of the blood both in asphyxia and anæsthesia, but it is now time to say that the alterations in color are not due to the appearance of either oxygen, carbonic acid, or any other agent. The changes are *induced* by them, but the diversity in color is merely one of form. Whatever tends to distend the corpuscles darkens the blood, owing to a change in its refractive powers, and the converse of this is also true. Thus carbonic acid distends the disks, carbonic oxide contracts them. Ether distends, and chloroform empties them, and accordingly under the influence of the former the blood becomes darker, while the latter makes it lighter in color. It is thus seen that changes in hue are not necessarily indicative of either the presence or absence of oxygen. It does not seem reasonable that the profound effects of anæsthesia are produced simply by a change in the *form* of the blood-disks. It cannot well be a lack of oxygen, for that is simply asphyxia. We must, then, come to the conclusion that the presence of the anæsthetic agent, as carried by the blood-corpuscle, does produce a profound impression directly upon nerve tissue, paralyzing it for the time, and making it incompetent to perform its proper functions.

This would seem to be the case, too, when we take into consideration the manner of progression of anæsthesia, which is from the extremities toward the central ganglions of the nerves. Anæsthetics also paralyze none but the sensory nerves. In both these character-

istics it is the direct opposite of woorari, which affects only the motor nerves, while its progression is from the centre toward the peripheries. These facts, too, seem inconsistent with the theory that anæsthetics produce their characteristic effects solely by the change in the nutrition of the anatomical elements of nerve tissue. Rather does it appear probable that their action is the invasion of a resistless enemy which, primarily attacking the outposts, where indeed it is first brought in contact with the filamental tissue, in its onward march lays its icy hand successively upon the delicate nerves, and rocks them in oblivion. Just what this power is, or in what peculiar manner it is exerted, we know not. We can study it only in the phenomena which it presents.

There are certain vegetable organisms which exhibit functions analogous to those of the nervous system of the animal world. The so-called sensitive plant presents a kind of embryonic or protoplasmic tissue which performs the physiological office of true nerve structure. *It is as easily anæsthetized as an animal*, and presents analogous phenomena when in an anæsthetic state.

Another reason why it seems to me incredible that anæsthesia is produced through a change in nutrition, is the fact that its agents affect nervous force when ordinary function and blood-circulation have ceased.

EXPERIMENT 10.—Remove the whole upper portion of the head of a frog, including cerebrum and cerebellum; open the thorax, take out the heart and lungs and cut off the extremities, leaving only the upper part of the alimentary canal. Two or three may be prepared in this way, when a smooth glass rod is thrust through each digestive canal, and its ends placed upon steady supports. It will now be found that the remaining portion of the frog will slowly travel along the glass rod, impelled by the vermicular motion of the œsophagus, and intestine, and the ciliary motion of the larynx. But if a bell-glass be put over one of the frogs, and a sponge wet with chloroform be placed within it, this motion either ceases entirely or is materially retarded.

Surely this cannot be from any change in the blood-corpuscles, for their movements have ceased. But there is a persistence of nerve function, especially in cold-blooded animals, which does not cease when other functions are lost, but which, true to its law, is suspended by anæsthesia.

It seems to me unreasonable to suppose that anæsthetics should produce their characteristic effects through an altered nerve nutrition, when we remember how instantaneous is nerve action. Entire loss of sensation may be the result of a simple external nervous impres-

sion, as by fright, or shock; and this not through syncope, though an impression may be wrought through any of the senses which shall entirely suspend sensibility by means of a syncope,—itself merely the effect of a nervous impression. The sight of blood, the hearing of unwelcome news, the touch of a loathsome object, the taste of peculiarly unpleasant substances, or the memories revived through a penetrating odor, may instantaneously deprive a highly-wrought nervous organization of sensation, and induce complete syncope. Shall we say that these impressions are produced by an altered nutrition? It seems much more credible that they are the effect of direct shocks to the terminal nervous filaments themselves.

I now believe that I have produced sufficient testimony to justify me in seriously questioning the correctness of the conclusions of Anstie, Sansom, Snow, Duroy, Lallemand, and others, that anæsthesia is due to an alteration in the blood-corpuscles, or to a changed nutrition.

There are some phenomena presented in the action of the more common anæsthetics which are at least peculiar. While they all affect the sensory nerves alike, or produce the same general phenomena, their reflex effects upon the motor system and upon volition are widely variant. Chloroform and ether produce entire muscular relaxation. Nitrous oxide usually does so, but the administration of most of the other agents produces spasms, either tonic or clonic. At least this has been my own experience. Bromide of ethyl I have known to induce spasmodic action almost like that peculiar to strychnine poisoning.

Why is there almost an entire immunity from danger when chloroform is used in parturition? It would seem as if this agent were expressly intended for such occasions. There are analogous phenomena in alcoholism, as in the immunity from the effects of certain poisons which inebriates possess. These unusual phenomena can only be explained by supposing that nervous tissue is then in such a condition that it is no longer amenable to the profound direct impressions of the anæsthetic or toxicological agents.

Other reasons might be advanced for the faith that is in me concerning the physiology of anæsthesia, but they would be but a rehearsal of what has been better said by others, and I forbear. It appears to me that in this direction lies a wide field for scientific exploration. The speculations of late physiologists have, so far as I am concerned, but served to befog the whole matter. What the character of nerve force is no man can say. It resembles electricity,

but manifestly it is not that energy. That there is an impetus and flow to the mysterious impulse seems demonstrated, and its velocity has been measured, and found in man to be about two hundred and fifty feet per second, while in frogs it is about eighty. This rate of progression alone proves that it is quite distinct from electricity, even were it not true that there is in the nerves no such thing as a closed circuit, and that the mere injury to a nerve-filament stops the current, although there may be no solution of continuity. Neither can nervous force be accounted for on the hypothesis of chemical action, any more than by the supposition of the ancients that the nerves were hollow tubes through which flowed a nervous fluid. The whole subject is a mystery, even to the actual office of the nerves, for they are not essential to life, unless we except those which preside over involuntary muscular action, and the severing of these is only fatal after considerable time has elapsed.

EXPERIMENT 11.—Anæsthetize a dog and sever both pneumogastric nerves. It will be found that almost immediately the breathing and the heart-pulsations become irregular, at first increasing in frequency, but later becoming much retarded. The animal will exist for some days, and will finally die from other complications than the direct stoppage of the heart through want of nerve impetus.

That irritation of a nerve acts as a stimulus and sends some kind of an impulse along its course, we know; and that certain drugs, acting through other organs, produce a decided effect, either of stimulation or sedation, we also know. That there must exist a functional harmony in the system, so that increased muscular exertion will be at once provocative of an increased blood supply, is an evident fact, and it seems to be the office of the nerves to preserve this balance. When we are able to comprehend the character of this nervous force we shall better understand the therapeutical action of anæsthetics; and it seems to me that this very study of neurosis and neurotics is the paramount physiological and pathological question of the day.

ANÆSTHETICS.

The relative safety of the most commonly employed anæsthetics has been much discussed, and this goodly city of Boston has led the way in the indiscriminate denunciation of one agent as always unsafe, and the commendation of another as comparatively harmless. It must have been a model professional coroner's jury which arrived at this sage conclusion. That we cannot with impunity so far interfere with a normal existence as to suspend some of the most important

functions of life must be apparent to all. But the average student desires to know if there are degrees in the risk to be run, and if so, which offers the least peril. For all practical purposes we may ignore all anæsthetic agents save chloroform, ether, and nitrous oxide gas. A long series of experiments, closely observed for the purpose of obtaining illumination on this point, has failed to show any definite reason why one agent should be always chosen to the exclusion of others. At one time an experiment, repeatedly tried with the same results, pointed to a marked difference in certain physiological effects upon cardiac tissue in the administration of chloroform and ether, and I was fondly of the opinion that we stood upon the verge of a grand discovery. But another series, undertaken to fortify the ground I was about to assume and to make assurance doubly sure, overthrew my inchoate theory and again impressed upon my mind the fact that Truth does not reveal herself hastily to the experimental novice. The record of observations was thrown away, and I commenced back again.

The progression of anæsthesia is gradual. It does not overwhelm the whole nervous system at once, but it conquers by detail, and this seems to be the order of its resistless attack upon the great nervous centres:

First—The cerebral hemispheres.

Second—The spinal cord.

Third—The general ganglionic system.

Fourth—The respiratory ganglia.

Each of the agents exhibits certain characteristic phenomena in its action, yet all follow the same general law. Certain definite quantities of any toxicological agent may be tolerated by the human economy, but that point once reached and passed, the peril commences. Were this point of danger a definitely fixed one, we might know when it was approached and avoid exceeding it, but the line of safety depends greatly upon modifying circumstances. During digestion relatively large quantities of any poison may be ingested with impunity. A freshly-fed dog will endure a quantity of woorari that would be speedily fatal to one which was fasting. In producing narcosis we usually desire to anæsthetize the whole nervous system save that which presides over involuntary motion. The danger consists in going too far, and lest the point of safety be overreached, common prudence bids us proceed with caution. Air impregnated with deleterious gases may be inhaled, provided the proportion be not too great. Carbonic acid gas always exists in the atmosphere,

and unless the proportion exceed two or three per cent. it is harmless. Even as high as five or six per cent. is not specially injurious to the person accustomed to its inhalation, and Berzelius says that a man will live for some time in an atmosphere containing thirty per cent. of carbonic acid. Of carbonic oxide one per cent. is injurious, and can be inhaled for but a short time. Chlorine may be breathed in small quantities with impunity, notwithstanding the well-known acrid qualities of that gas. We see, then, that any gas may be so largely diluted with air as to fail to produce its toxicological effects. But there is a proportion beyond which we cannot go in the inhalation of any gas or vapor which will not support life. Exhaustive experiments have abundantly proved that not more than five per cent. of chloroform or ether can be breathed without extreme danger, and the observations of Lallemand, Perrin, and Duroy have demonstrated that an atmosphere of eight per cent. of chloroform is fatal, while two per cent. can be breathed a long time without inducing the anæsthetic state. That the great danger in the administration of any anæsthetic lies in allowing the patient to breathe an atmosphere too highly charged with the vapor is incontestably proved, and it must be accepted as a fact. I have not the time to enter into a further discussion of this subject, or to adduce the volumes of proof which are at hand, but the truth of the assertion is not disputed among experts in the administration of ether and chloroform. In the usual methods of giving these vapors a patient may easily be made to breathe an atmosphere of ten or even twelve per cent. What is the inference? *These agents should never be employed without the aid of an inhaler which may be implicitly depended upon to properly dilute the vapor.* In the use of nitrous oxide safety lies in withdrawing it before narcosis shall have proceeded too far.

In the use of chloroform, ether, and nitrous oxide there is a certain train of symptoms, each following the other with considerable regularity, but not, in the several agents, with the same degree of intensity. The first stage of anæsthesia is one of hyperæsthesia and excitement. There is an increased flow of blood through an accelerated action of the heart, and a dilatation of the capillaries, with contraction of the iris. This is especially marked in exhibitions of chloroform, and during its administration the excitement or hyperæsthetic stage is sometimes very violent; and it is at this time that the danger is particularly imminent in cases of lesions of the heart. Under the stimulus of the great sympathetic, if the muscular tissue

of the heart be weakened by fatty degeneration, or if there be marked diminution of its left ventricular capacity, its spasmodic struggles may result in an embolism when, as is usually the case, the muscular coats of the arteries are weakened through the irregular action of the heart, or that organ may itself become paralyzed through its extraordinary efforts to respond to the exertion demanded. Death then occurs either through spasm of the heart, or paralysis of the sympathetic nerve. The most reliable statistics show that more deaths occur at this stage of chloroformism than at any other, and I never heard of such an unfortunate termination in which the agent was not pushed beyond the bounds of prudence in allowing an atmosphere too heavily charged with the vapor.

Another symptom attending this stage, or immediately preceding it, is the choking sensation, or feeling of suffocation, attended frequently with violent coughing and spasmodic struggles for air,—another indication that the vapor is not sufficiently diluted. These symptoms may arise from two causes. I have in the first part of this paper shown that chloroform and ether modify the ability of the blood-corpuscle to absorb oxygen, and if the atmosphere be too highly charged with the vapor of either, the medulla soon manifests its imperative needs by spasmodic struggles for breath and by symptoms of asphyxia. The coughing arises from irritation of the terminal filaments of the glosso-pharyngeal nerve, as is proved by the loss of taste, and by the fact that if tracheotomy be performed and the vapor introduced through the tracheal tube, no such symptoms are ever observed. Any of you who have experimented with animals when the nozzle of a bellows was introduced into the trachea for the purpose of artificial respiration, and have anæsthetized the animal by means of a sponge applied to the valve, must have noticed this.

The next physiological sign in narcosis is contraction of the arteries, due to a still more profound impression upon the vaso-motor system, and the beginning of the loss of sensation in the extremities, as indicated by a tingling feeling in the fingers and toes, which gradually extends toward the vital organs.

If the excitement stage be once safely passed, chloroform narcosis proceeds quietly until the sensory nerves of the cerebro-spinal system are quite paralyzed, and if it be not pushed too far, the danger is very remote. If chloroform be properly administered and closely watched, it is not as dangerous as has often been represented; but its exhibition *absolutely demands* the services of a skilled expert, for as it is more powerful than any of the other agents, it requires greater care

on the part of the administrator. Especially should the iris of the eye be closely watched, for though in its later stages the pupil is expanded, caution must be observed that the total relaxation of coma be not approached. The danger is chiefly during the excitement stage, and then it is usually the result of want of prudence in allowing too great a proportion of the vapor.

In ether narcosis the excitement period is seldom attended with such violence as with chloroform, and hence there is less danger at this time, for the instances in which ether has proved fatal through paralysis of the heart are very rare indeed, if they exist at all. In all cases of death from ether of which I have any knowledge, the heart has pulsated some time after the cessation of breathing, but with chloroform it is the reverse. Ether, like chloroform, first stimulates the heart, but it does not seriously depress it afterward. The great danger in the administration of this anæsthetic is from the arrest of respiration, and this is due either to a paralysis of the sympathetic, or more often to the filling-up of the smaller bronchi by mucus, through the destruction of the sensibility of the membrane lining them, and the consequent cessation of the ciliary motion of the villi, which carries the mucus forward until expectoration can remove it. In nearly all cases of death from ether it will be found that bronchial râles and stertorous breathing precede death, the latter symptom being due to paralysis of the pharynx. By the expert the unfavorable symptoms from chloroform may be earlier and more surely detected than can those from ether.

The progress of narcosis, according to Anstie, is in its effects manifested—

First—Upon the cerebral hemispheres.

Second—Upon the cerebellum.

Third—Upon the medulla oblongata.

And the narcotized individual will lose—

First—Local sensibility in the extremities.

Second—The intellectual powers.

Third—The general power of co-ordination.

Fourth—Power of receiving sensory impressions.

Fifth—Power of breathing.

Sixth—Involuntary muscular action.

There seems to be, also, a general progress of anæsthesia through the cerebral nerves from the anterior portion of the brain posteriorly, for the first sense which is lost is that of smell, as is demonstrated by the usual demand for more of the agent, and this demonstrates a par-

tial paralysis of the first pair of nerves. This phenomenon is readily accounted for by the fact that the anæsthetic reaches the terminal filaments of the olfactory nerves before it is presented to those of any other, and is an additional argument in favor of the theory that anæsthetic effects are produced by a direct impression upon nerve filaments. After the loss of smell comes loss of sight, loss of ability to control some of the muscles of the eye, and an enlargement of the pupil, owing to paralysis of the ciliary and recti muscles, which indicates the overcoming of the third, fourth, and sixth pairs of nerves. About this time follows loss of sensation in the integument of the face and eyelids, of the muscles of the tongue and of the teeth, indicating paresis of the fifth. This is followed by loss of the expression of the face, and of hearing, denoting a paralysis of communicating nerves of the seventh and of the eighth, while the tenth, eleventh, and twelfth pairs of cranial nerves are the last to succumb.

Of nitrous oxide and the bromide of ethyl, time forbids me to speak extendedly. The first, the especial refuge of quacks, is of use only in brief operations, like the extraction of single teeth and the opening of abscesses. With the last my own experience has been anything but pleasing. In its administration to the lower animals, clonic spasms, sometimes of a very violent character, have induced too great a distrust of its safety to warrant me in giving it to human beings. There are many other things of which I would be glad to speak, and many experiments and vivisections which I have made, especially some illustrating modifications in the circulation of the blood, which I would desire to relate, but I spare you the recital.

My own experiments and observations in the use of chloroform and ether would lead me to use especial caution, in case of the former, to see that there had been no indication of weakened heart's action, as exhibited by fainting and dyspnœa; to use especial caution with those addicted to the use of alcohol, and to be particularly careful to give thorough dilution of the vapor until the excitement stage be passed. Finally, to carefully watch the later stages of anæsthesia, and to suspend the administration at the first indication of any excessive dilatation of the pupil, of stertorous breathing, or of relaxation of the muscles of mastication, as these are governed by nerves which arise from the medulla, and indicate danger to the sympathetic system.

In ether narcosis, instead of watching so carefully the action of the heart and the pulse, I pay particular attention to the respiration, and at the very first appearance of bronchial râles I suspend the administration. In case of the persistence of unpleasant symptoms from chlo-

roform, the utmost exertion should be put forth to stimulate the heart to action, such as the administration of arterial stimulants, electric currents, and nerve shocks. If the danger occurs in ether narcosis, pay little attention to the heart or pulse, but commence artificial respiration, and persist in it until long after hope shall have almost fled. Several instances are on record where artificial respiration, after the methods recommended by Marshall Hall or Dr. Silvester, has resulted in recovery long after the patient had been pronounced irrecoverably dead. In both cases keep up the temperature by artificial heat. Many a life has been lost which might have been saved only for allowing the temperature to be reduced by the subsidence of functional activity. In any case, a cool head and the possession of all your faculties, with perseverance in the use of restorative measures, will enable you to overcome the most determinedly adverse symptoms, and prove you worthy to be trusted in the gravest complications.

DISCUSSION.

Dr. Werner: I like the tone of Dr. Barrett's paper very much. It gives many experiments that demonstrate to me the incorrectness of views formerly held and, to other minds, well settled. In regard to blood that has been oxygenated by passing it through lungs that have been taken from an animal, an important point to be considered is whether the tissue of those lungs was molecularly dead, or was still alive, and could perform for a brief period its functions as if actually in the body. I should judge that in one experiment the latter was the case, and that oxygenation of the blood could be carried on after molecular death of the lungs was not proven. If the lungs have been removed some hours, and have been kept warm and moist, the molecular vitality would not necessarily be destroyed.

It has been settled, I think, generally, that a being when born into this world does not breathe because he is exposed to the air, but because he is in want of oxygen, and if that want is artificially supplied he will not breathe.

If you pump oxygen through the umbilicus, he will not use his lungs so long as you continue to supply him sufficiently with oxygen through that channel.

In regard to pressure upon the medulla, in which are situated those important nerve-centres that control the heart, the lungs, and the vascular system generally, it must be borne in mind that pressing

upon the medulla may stimulate to such an extent that one can trace a decided change in the vaso-motor systems, and such a change may, for the time being, stop symptoms of asphyxiation. This has been accomplished. But simply pressing upon the medulla would not effectually stop an asphyxiated condition. It would only stir up a counter-irritation for the time being. One point was made on nitrous oxide. I do not think it is generally considered that nitrous oxide oxygenizes the blood. The fact is it deoxygenizes the blood, for the oxygen is in such a condition that it cannot be utilized. Narcotism does not begin until asphyxiation has been carried to such a point as to sufficiently anæsthetize a person for a short surgical operation. Few of the operations performed by dentists require the patient to be narcotized, for when narcotism is produced with nitrous oxide it becomes very dangerous, because it affects the inhibitory centres that control the heart. Excessive dilatations of the heart and the general vascular system may result in rupture of the heart, or rupture of the different vessels, principally those of the brain.

Respiration depends not upon any pressure brought on any part of the body, but entirely—and I think this is very well settled—upon the want of oxygen. When that want of oxygen is supplied, by the umbilicus, or otherwise, it is sufficient.

One point was stated in the paper which I like very much, and that is that under the effects of chloroform people die from nervous shock, and not from suffocation. People die from extraction of teeth because the fifth pair of nerves are closely connected with the pneumogastric nerve, which supplies the heart, and shock to the latter nerve results in instant death.

Dr. Atkinson: This is too voluminous a paper to answer in the off-hand speech permitted me, for several reasons: from the inarticulateness with which some of the basal statements were pronounced, and from the inability of anything but the illuminated consciousness to gather such immense tropes of reaches for principle as are contained in the paper. My objection is to coming to conclusions that won't conclude,—simple assertions of an ability to comprehend things adversely by a novice,—to the operations and conclusions and opinions of men who have spent their lives with greater facilities than it is fair to conclude were had on this occasion. As to the truthfulness of the observations, I accept them profoundly.

I have not the first lingering doubt but that the purpose is just what it should be, and I want to congratulate this body that it has lived to see the day when such a paper can be presented and listened

to with the attention that this one has received. But there are several statements in it that I will only say generally I disagree with; some of them for the want of conclusiveness, others for the want of verity. Take, for instance, the statement that CO_2 has any action upon arterial blood. It is distinctly stated in the paper that if you will mix CO_2, commonly known as carbonic acid gas, with arterial blood, it becomes venous. Any man that will show me that is entitled to a Delmonico dinner.

Dr. BARRETT: I will have the dinner.

Dr. ATKINSON: Another statement was made that is new to me,—that it was generally understood that nitrous oxide supported respiration, or, in other words, "oxygenated blood;" I think the latter was the term that was used. Now, without denying or asserting that, I will state a palpable truth: That if the oxygen that has already found means of engaging one of its bonds of affinity with nitrogen is circulating in a blood territory where there is venous blood, there must be a decomposition of the NO before there can any awakening occur of the normal bonds of affinity in the oxygen, so that it shall become capable of oxygenating the blood. At least, it must have the bond holding the nitrogen severed before the oxygen can be free to be even carried by a blood-corpuscle.

There is some ambiguity in the paper and apparently in the apprehension of the mind in the investigations as to what constitutes circulation, and if you will go back to the books, then the paper is justified; but I take it that where men attempt experiments that had engaged histologists and naturalists for a long time, they should be careful how they operate, and see that they do comprehend what is going on, so as to get a correct interpretation of the results that seem to follow their manipulations. Huxley, in his "Physiology," says that carbonic acid gas is a "negative poison." That is positive nonsense. What is a negative poison? A negative activity. Whether that was purposely said by Huxley or not, such has been his superior shrewdness and competency that men have followed him even in his errors. My friend, Dr. Werner, makes also this statement that he considers uncontradicted, that it is the lack of oxygen alone that constitutes asphyxia.

Now, I have a word to say as a fellow-seeker for truth as to what does occur in respiration, and to assert it, not dogmatically, but suggest it as my prevision, that the essential element of respiration and necessary nutrient activity has never been taken into account by physicists. I base this opinion upon well-observed and well-estab-

lished facts. The lungs will receive one hundred per cent. of oxygen diluted with nitrogen and only appropriate four per cent., and in the air exhaled from the lungs there will be ninety-six per cent. of the oxygen that was within the grasp of the lungs. The bonds of affinity in that oxygen have been so set to sleep by reason of their having been in the lungs that it is unfit for respiration. Does that lead your minds to the apprehension that there is something finer than any molecular body in atomic presence that is the cause of the support of vitality in any organism that respires? Until we shall have gone to the bottom, all that these experiments are worth is simply an accumulation of facts under which the world is to-day groaning, without the ability to interpret to the satisfaction of a clear-cut perception that has in it any morality, any love of truth.

We all love the truth for ourselves. Do we take as good care that only sound statements shall pass the portals of our lips, that are the divine trysting-places of the intelligences of the spheres, that we may interpret the careers of the bodies with which we meet, the origins and causes of which as yet we know nothing in a scientific way, save through inspiration—clear and clean revelation of truth to the consciousness of the individual!

If we are talking of circulation, we have, involved, all that I have suggestively stated, that we must recognize a fountain from which whatever circulates takes its start on a circuit through which it goes and a destiny to which it returns. If we are confined to the heart, we shall not have an explanation. Bichat long ago said the tripod of life is "innervation, circulation, respiration." What are the currents that we have to deal with in asphyxia? This special subject was nominated anæsthesia,—privation of feeling, that was all.

What have we in circulation? Does the blood circulate by reason of energy in the blood column? By no means. The vaso motor system was spoken of by one speaker, and that it had a dual root in the medulla. Why the dual root? What circulates in the vaso-motor and in the sensory lines of the nerve tracts? It is this same thing that in the heart they call "Accasa."

Let us see that we have a triple manifestation of energy in every circulation, and that when we arrest any one of the three legs of the stool, it topples over, so that if you stop respiration you have innervation and circulation arrested, and what is called death ensues.

Dr. SHUMWAY: I think the thanks of this body are due to the gentleman from Buffalo for the paper that he has presented here, and the practical suggestions which that paper contains. My own experience

and observation wholly conform to what the writer has said, in so far as practical results are concerned. He has carried experiments so far as to justify him in making statements here which none of us would be justified in making. I have felt for a long time that this subject had not been so thoroughly digested and put before the dental profession as it should be. I feel that whenever I have made use of an anæsthetic, I have taken the life of my patient in my hands, and that there was a degree of responsibility resting upon me that demanded that I should bring to bear the greatest amount of intelligence, in order that I might do the best possible thing, and I think that this paper is the most timely and suggestive one that has been presented with which I am acquainted.

Dr. BARRETT: What little I may have acquired of manual dexterity in the performance of physiological experiments I owe to Prof. W. H. Mason, of Norwich, Conn., the Gamaliel at whose feet it has been my privilege to sit; one of the most enthusiastic of teachers, and a manipulator whose skill is unsurpassed. It is but proper and just that I should render this public acknowledgment of my indebtedness to him, for many of the experiments upon which I have relied for conclusions are original with him, and I have drawn my deductions indifferently from his or my own vivisections.

I stated to you at the outset of my paper that what I had to say was advanced with great diffidence, because I knew that the conclusions which I had reached were in direct conflict with those of the chief authorities. I do not presume to set up my opinion in opposition to that of these eminent men, neither am I willing to accept these or any other person's views unquestioned on matters which I may investigate for myself, be the subject professional, secular, or religious.

When I perform an experimental operation, and it seems to demonstrate to me a certain truth, it matters little what eminent authorities hold opposite views. I perhaps endeavor to use extra precautions to eliminate any possible source of error, but I stand by my own judgment. When people of other opinions demonstrate to me my error, I shall be glad to acknowledge it. If any gentleman now present will point out to me any false reasoning or deduction from fictitious premises, I will heartily thank him, for it is TRUTH, and not a polemical victory, that I seek. No one need desire to spare my personal feelings or pride of opinion, for if such a thing is resident in me, it is time it was eliminated. I have audaciously called in question the opinions of men to whose knowledge I cannot pretend

to aspire, and it would come with poor grace from me to refuse to another, my equal, what I claim from my superiors. But I do object to wholesale denunciation. I do protest against such indiscriminating assaults as have been made upon a paper read here yesterday, especially when the author is not present to defend it.

PRESIDENT: The gentleman is not talking to the question; he is talking personalities.

Dr. BARRETT: I do not intend to talk personalities, and utterly disclaim any such meaning. But I do protest against any indecency of language in either commending or denouncing a paper. Every gentleman has a right to an entire courtesy, and his views are not to be ridiculed or denounced except they be first disproved. Let us show what is bad, let us test what is good, and if error be detected let us demonstrate wherein it lies.

There have been one or two new views expressed which I wish to notice, and one or two misunderstandings which I wish to correct. It has been stated that I claimed that nitrous oxide oxygenated the blood.

Dr. ATKINSON: I did not say so. Let me restate what I said: that he said that that was the prevailing opinion among dentists.

Dr. BARRETT: And I will stand by that opinion every time. There was another point. The gentleman states positively that CO_2 will not darken blood-corpuscles. I as positively affirm that it will.

Dr. ATKINSON: I did not state it would not. I offered a Delmonico dinner to any man who would prove it would.

Dr. BARRETT: Many a time have I taken bright oxygenated blood and have shaken it in a jar with carbonic acid gas, and always, invariably, was the color changed. Surely, there must be more than one present who has either tried this experiment or seen it tried.

Dr. WERNER: It will change it.

Dr. BARRETT: Is there any other witness to the truth of my assertion? Yes, there is another. We *know* it will change it.

A MEMBER: Was the air exhausted from the bottle before the blood was introduced?

Dr. BARRETT: That is not a part of the experiment. Were the air to be exhausted by means of a pump, or by any other such artificial method, all the environing condition would be altered at once, and the whole experiment vitiated. Such a method would remove all the free oxygen, and so alter the state of the blood that it would be not at all analogous to its natural condition. Besides, the carbonic acid will quickly enough remove all air in the jar not held in the blood.

It is so much heavier that it displaces the air as effectually as would water. I am astonished that the gentleman does not comprehend that fact. Any one competent to call in question so obvious an experiment should be fully aware of this. But the test is an easy one. Go home, gentlemen, and try it for yourselves, and then you will know positively, and not need to rely upon guess-work.

Dr. BROPHY: The question has arisen as to whether nitrous oxide oxidizes blood, and the gentleman has stated that he believes the opinion that it does is accepted by the greater portion of the profession.

Dr. BARRETT: I do not allude to members of the American Dental Association. I refer to the profession at large, country as well as city. All of us are aware that nitrous oxide is advertised throughout the land by the Cheap Johns as Vitalized Air, and the greater part of the profession, so called, to-day believe it air enriched with oxygen, and differing from atmospheric air in nothing else. What does the average dentist know of chemical combinations? How long would it take you to make him understand the difference between the mechanical mixture of O and N, which constitutes the air we breathe, and the NO of protoxide of nitrogen? They verily believe that it at least ought to furnish all the conditions for supporting life.

Just what the physiological action of nitrous oxide is upon the blood I am not now prepared to state, but I hope another year to be able to demonstrate it to you.

Dr. BROPHY: I believe the gentleman is mistaken. Among the more intelligent members of the profession I think this matter is better understood. There are a great many intelligent men in the profession who, I regret to say, are not members of this Association.

The question naturally arises, What does nitrous oxide do when inhaled as an anæsthetic? How does it prevent oxidation of the blood? I consider that it does for this reason.

Nitrous oxide gas is a combination chemically of nitrogen and oxygen, in the proportion of two of nitrogen and one of oxygen, N_2O; therefore we have a chemical union. Atmospheric air, as we all know, is a mixture of gases,—nitrogen and oxygen; therefore, when nitrous oxide gas is inhaled, the bonds of union, although not exceedingly strong, are sufficiently so to prevent the blood from receiving oxygen, therefore carbon dioxide accumulates within the blood. These are the views I have held in regard to this matter for some time. I have met with gentlemen who have opposed them, but I have yet to see it proved that it is not true.

Dr. WILSON: I am from the country myself, and I think I can speak with some experience on this point. I think that the general run of the profession know nothing about the composition of air, and they do not know the difference between a chemical compound and a mechanical mixture; and I think I can safely say there are a great many who cannot understand the difference between the two without more and better information than they at present possess, and they no doubt regard vitalized air as about the same thing as our common atmosphere, and for that reason I think Dr. Barrett's statement is correct.

Dr. BARRETT: I suppose that no gentleman now present will understand me as having made the assertion that protoxide of nitrogen oxygenated the blood, or that I was of the opinion that the intelligent portion of the profession entertained such a belief. But I am of the opinion that, numerically, the greater proportion of dentists believe that nitrous oxide is a gas which will sustain life. They do not reason it out to that point, but they have a kind of foggy idea that it will purify the blood, and that it can be breathed like common air.

Dr. BUCKINGHAM: I agree with what my friend on the left has said, that we do not know anything about it. If we depended upon oxygenation of the blood for producing anæsthesia, oxygen would be the best agent, but it does not produce the anæsthetic effect. That proves that free oxygen is not the active agent in these cases. Because there is oxygen and nitrogen combined together there, it is no reason to suppose that the combination may be decomposed when it comes into the circulation of the blood. It acts in some way we do not understand. Chloroform, ether, and nitrous oxide all produce the same effect.

The chemical composition you all know is different. Chloroform will not burn, ether is highly combustible, and nitrous oxide is the supporter of combustion. A celebrated experimenter undertook to show that he could demonstrate the effect of an anæsthetic by putting a light under a vessel and letting it burn out the oxygen, depriving it of oxygen and produce asphyxia. That was his idea,—merely to deprive the lungs of the oxygen, and produce the anæsthetic effect in this way. We do not know how it acts: it acts in some way by paralyzing the cell. It is probably, as Dr. Barrett has said, carried through the circulation. It comes in contact with the living functions of the body,—not the man himself, but the individual cells,—and it produces a paralysis of these cells in some way that we do not understand.

There is no man who will undertake to tell us how the action takes place in the cell itself, or how the cell grows up.

We can trace the circulation of the blood, we can trace it through the capillaries, we can suppose it goes around to the whole circulation, but it is not there that it produces nutrient or physiological effects, it is in the cells themselves; it must pass out of the current.

There has been a very fallacious idea in regard to that, that you must have capillary vessels carry the blood through the parts in order to have nutrient air.

It is on the outside where it produces the effect, and when it goes through the cell itself, and goes into the working body of that cell, it produces that effect. There is the life-course, and whenever you paralyze that in any way you paralyze the whole.

Dr. WERNER: I wish to ask Dr. Barrett if he believes that blood is mechanically oxygenated.

Dr. BARRETT: Most certainly, so far as the presentation of air to the blood is concerned,—that is, it is not necessarily a *vital* process. Remove a dog's lungs from the body, having first forced through them a quantity of defibrinated blood to clear them of obstructing coagulum. Now, into the pulmonary artery, by means of a large syringe, force a quantity of defibrinated blood, at the same time keeping the parenchyma expanded by means of bellows in the trachea, and the blood which exudes from the pulmonary vein will be distinctly oxygenated. This experiment I have repeatedly tried, and it clearly proves that vital currents and movements have nothing to do with oxygenation of the blood.

Dr. WERNER: When oxygen is taken up through lungs that have been extirpated, why should it not oxygenate the corpuscles when the lungs are not extirpated and are still in the body? Or if it is simply a mechanical process, why does it not oxygenize the blood when nitrous oxide is inhaled? From the fact, I think, that the elements are eliminated from the lungs, and that it requires a getting-rid of certain things before a taking-up of others—oxygen—can be accomplished. No man has been able to thoroughly analyze the exhalations from the lungs of a being to whom nitrous oxide has been administered, and with some authorities it is a question whether persons ever take absolutely pure nitrous oxide. This gas is such a difficult thing to keep that it is hardly possible to administer the pure article except the animal be submerged in the gas, and not *forced* to inhale it. We know that the inhalers are so imperfect that, when Dr. Barrett

administers forty gallons to a dog, he likely administers twenty of air and twenty of nitrous oxide, and that is why the animal is not asphyxiated or narcotized.

If he were to administer pure nitrous oxide, the animal could not inhale more than six or seven times before it would be partially asphyxiated, and directly after that would become narcotized, too.

The Unwritten Law of Dental Ethics.

Volunteer Essay by C. A. MARVIN.

ALMOST every dental society has its code of ethics,—more or less elaborate, more or less stringent. It is incorporated in the printed by-laws, and provision is made in the same laws for the prosecution and punishment of any and all who are charged with the infraction of said code and are found guilty.

As the code of ethics which governs any society has been adopted by the same vote as that by which the other laws were enacted, it follows that as the general by-laws are the formulated views of the members as to government and procedure when in convention assembled, so the code of ethics must be taken as the formulated expression of the same membership as to what constitutes consistent, honorable, professional conduct. Ethics is a system of morals, and, strange as it may appear, it is deemed important, nay, necessary, to put into words—actual words—the rules which should govern honorable gentlemen in their intercourse with each other and with the public. It is not considered safe, let it be observed, to leave such intercourse to be governed by the natural instincts of the gentlemen themselves. It is not intended to comment on this necessity, or felt necessity, but merely to state the fact.

Just here a nice question might be propounded, viz., Whether the fixing of certain rigid rules of conduct insures as high-toned and exemplary demeanor as the operation of the principles of honor and integrity when left to work out their own natural result without restraint of law? When a code is made, observance of the letter of the code is all that is required. The principle beneath is hidden. May not the attention be so engrossed by the prescribed rules continually set before us that all thought of that principle beneath is precluded? Indeed, may there not be an absolute disregard of the existence of any principle there whatever?

Leaving the two thoughts just suggested for any gentleman to meditate upon if he so desires, I pass on to the immediate object of this paper, which is to call attention to the ethical principle which should govern professional action at all times, and to the ease in

which it *may be* (shall I say it *is?*) violated without coming in conflict with the written code and incurring its penalties.

The fundamental principle of our code of ethics is, a courteous regard, on the part of every dentist, for the rights, the feelings, the reputation, and the interests of every other dentist; also for the dignity of the profession itself. Anything that is in any wise adverse to this principle is an infraction of ethics, whether the code specifies the particular act or not.

It is deemed unprofessional, for instance, to advertise one's self, and it is so stated in the written law; but may not expedients almost numberless be resorted to to accomplish this very end? I mean other than the proper participation in public discussion of professional questions or writing for journals. These are appropriate, are expected, are incumbent upon practitioners.

Now, it is not held in this paper that it is improper in a professional man to make himself known in the community. It is right. It is his duty. He owes it to himself and his family. But there is a proper way to do it. It is more becomingly done by letting his light shine out, as light streams forth from the windows of a brilliantly-illuminated house, than to make a forced parade of it. People understand quite as quickly that there is a light within the house as they would were a bonfire built in front of it and a bell rung to call them to look at it. So the ability that will not stay imprisoned within a man, but displays itself by reason of its own diffusive nature, must command attention and win favor more hearty, more enduring, than when egotistically paraded by the owner. Indeed, its genuineness in the latter case is often doubted, and with reason. It is not necessary, for instance, that special attention should be invited to the particular degree one is entitled to affix to his name, nor that a comparison be instituted between it and that which has been conferred upon some other man. The degrees are not affected by such boastful talk, but the speaker is, and, in the minds of sensible persons, not at all in the direction he intended. Such violations of the spirit of ethics are not entirely unknown.

Again, when in speaking of certain departments of dental practice which the speaker pursues, allusion is made to some other practitioner who omits some one of these in his practice, and the omission is held up as an evidence of lack of attainment or proficiency, a violation of the spirit of ethics is committed. One's own kind of practice can be made matter of conversation properly, and one's ideas as to the comparative value of departments may be expressed with propriety, and

one's views as to general or special practice may be given freely, and no offence against propriety be committed. The offence consists in the disparaging comparison of another with one's self; in so shaping the conversation that self shall be exalted, and not only so, but exalted *at the expense of that other*. This is unethical; this is dishonorable. Is it ever done?

The success, however, of such a course is short-lived. The public will learn what dentist is reliable in the department of prevention of decay; of the arrest of decay; of saving greatly weakened teeth; of restoring to usefulness wrecked teeth; of correcting irregularities; of treating oral diseases; of constructing artificial dentures; and if this information is gained through others and not through the practitioner himself he stands much higher in consequence. In service as important, as publicly known as dental service, the injunction in the old adage becomes inevitably a statement of fact, for "every tub" *will* "stand on its own bottom."

The *spirit* of ethics is very wide-reaching in extent, and capable, if truly appreciated and obeyed, of working a revolution of no insignificant dimensions in dental action.

It has been noticed possibly that in our profession, as in others of a scientific character, there is not an *entire* want of superciliousness on the part of advanced men towards men of less attainment. Neither is there any *excess* of the disposition to encourage young practitioners, timid speakers, earnest but not yet profound thinkers.

On the contrary, has there not been seen a disposition to tower above, and in the confidence which experience has given, to overawe these diffident brethren by loud tones and high-sounding phrases?

If this is so, not only is the spirit of true ethics violated, but an evil is quite likely to ensue of wider extent and more baleful nature than may at first thought be perceived.

If the timid brother's feelings are wounded and his voice silenced, his ethical rights have been infringed and the principle which should govern professional intercourse has been as truly violated as though some written article of the adopted code were broken.

Besides this, there is sustained a loss on the part of the society,—the loss of that brother's *true* views. He will, if inclined or urged to speak, either conform his views to those of his assumed superior to avoid criticism and win his favor; or, if honest enough to hold his own opinions and to decline to accept, on statement, those which clash with them, he will keep his seat and preserve silence. His

mind will not cease its operation, however, so that, like the owl, though silent, he will keep up considerable of a thinking. But *what* he thinks, however useful and interesting it might be, will not be likely to be known. Hence a loss to him and to his society.

The phase of ethics which we are considering has two sides, and to be fair we must look at both. If it is unethical to criticise rudely the diffident brother who is doing the best he can, it is quite as much so for any one, strong or weak, bold or diffident, to occupy time when he has nothing to say, or compel gentlemen to listen while he utters in a hesitating and stumbling manner crude, half-formed opinions which distress but do not edify his hearers. So that, while the leading members of a society should encourage the more retiring to take part in the business of the meetings, these should *prepare* themselves for such participation, that what they do may be for the benefit of some *one* or for the *general* good.

Time is valuable. Time lost can never be regained. Time well spent is time saved. Time so occupied that instruction is gained is time well spent. Time consumed in uttering meaningless words is time wasted.

From these axioms the inference respecting our duty is inevitable. Ethically considered, it is our duty, each one of us, to avoid whatever would cause loss to another. If I waste time which another might use to advantage, I defraud somebody. If I claim the attention of gentlemen while I speak nonsense, or speak wanderingly, or impertinently, or tediously, I defraud many, and as the fundamental principle of all ethics is regard for others' rights, I commit a breach of the great, wide-reaching, unwritten law which is my text to-day.

Perhaps we have not thought as much of this as we ought. It is a truth generally very little considered by men when gathered in convention, to say nothing of other times. It should be considered and should be observed, and its consideration and observance would accomplish good. It would not, as might be hastily concluded, discourage debate, but would make it more pointed and practical. It might reduce the number of words spoken, but would not damage the ideas presented. It would insure the *possession* of ideas by every one who should claim the attention of the assembly.

It would stimulate the habit of rigid thought, and educate a man to refine his ideas in the glowing fires of his mental furnace, that the real substance may be perceived, its dross burned away. Crude ideas are better than no ideas; but when sufficient time has been taken to

mature such ideas, before presenting them for the reception of hearers, it is better still. Crudeness may be amusing at times, but is not gratifying. It is often tolerated from a sentiment of good-nature, or because an immediate response to an unexpected call has afforded no time for maturing one's views, but the manifest expression of distress resting upon the countenances of the audience shows how little they are gratified. And when at such times a speaker insists upon holding the floor, and compels his hearers to be the unwilling spectators of his terrible struggle with a half-delivered thought that rebels against being born, and then repeats the painful exhibition again and again, who is edified? Edified! Who is not the rather rasped to an every-fibre-searching shiver? Who has not felt that the full time had come for some Berghian champion of human comfort to arise and prevent further cruelty?

So that when raw, unformed ideas are received with any degree of favor, it is not that in such immature form they are pleasing, but because of some recognized necessity for that immaturity which calls for the indulgence of the hearers.

But it should be well understood that it is unsafe, as it is truly unethical, to *presume* upon this extension of indulgence, and neglect that study and preparation which would spare the audience a repetition of the infliction they have already suffered. They might not bear it as patiently again, hence it is unsafe; they ought not to be made to suffer it again, hence it is unethical.

The more this subject of ethics is pondered, the more clearly will it be seen to stretch itself along the course of professional action, touching it again and again, until, to the earnest gaze, it shall assume the dignity and majesty of *law*, to which conduct must conform or be faulty, rather than a pretty sentiment hung as an adornment upon the conduct and adapting itself to all its variations. A close scrutiny and a construction no stricter than the principle will easily bear, will reveal to us, in the unwritten law of ethics, an inflexible standard, whose rigid righteousness would expose, to our shame, oftentimes, much irregularity, much variance, were our conduct compared with it.

Not only are our relations with our fellow-practitioners affected by the ethical principle we are considering; our relations to our profession as a noble science, and to the public as the recipients of our service, are concerned as well. There are duties we owe to both; and where—*anywhere*—are duties there ethics has its place.

What is our duty to our profession? I have considered this ques-

tion in a paper written many years ago, and shall therefore answer it very briefly at this time.

In a word, then, the dentist's duty to his profession is to maintain its dignity, to increase its efficiency, to make it honorable in the eyes of men.

Any course of action which will diminish public confidence in dentistry as a profession is a breach of duty, and every breach of duty is an infraction of the principle of ethics. Hence, poor practice, imperfect operations, unskillful treatment, wasting of time, whether resulting from carelessness or ignorance, are unethical.

Hence, extravagant boasts of the advancement which dentistry has made, not sustained by the practice of the boaster; large claims for the sufficiency of dentistry in specific cases of disease, obscure and severe, not followed by the expected success in cases actually under treatment, are unethical.

Hence, surgical operations so clumsily performed that the patient and his friends are not at all persuaded that he has fared better in the hands of the specialist than he would have done in those of the general surgeon (the result being an unfavorable opinion of dental surgery), are *unethical* as well as discreditable.

Hence, undignified deportment and a disregard of the courtesies that are expected to distinguish the professional gentleman, a clownish manner and a slangy speech, a repulsive person or a rough touch, are unethical.

Hence, profuse conversation interlarded with unnecessary scientific terms, which is so superficial that the listener gathers no information and is only puzzled by the terms and wearied by the clatter, is unethical.

Something more may, with propriety, be said in this connection.

It must not be supposed that because our patients are not dentists they are unable to weigh our conversation, or to decide very quickly whether we are talking sense or nonsense, intelligently or at random.

A free use of scientific terms will not pass for well-expressed ideas, nor redound half so much to the credit of the speaker as the simple language which conveys some useful and appreciable thought.

Dentistry is a positive science as well as a practical art, and a practical art as well as a positive science.

Abstruse philosophy, however attractive, has no value to the practitioner whose mission is to achieve palpable results. The power of reasoning is a wonderful attribute of the human mind. But of what use is reasoning except a point is aimed at, and except that

point be a practical one? The work of life is to the last degree material, not ethereal. Signally so is the work of our profession, and the dentist who would be ethically faithful to his calling in the particular of making it honorable in the eyes of men must be mindful of this fact. When he talks, let it be to express an idea. Let him cultivate the faculty of expressing his idea clearly and concisely, and when thus put forth, of letting it alone. When he reasons, let it be from a promise, accepted and demonstrable, by logical procedure, to a conclusion desirable and in advance of the starting-point. When he advises, let it be seen that he has a reason for his advice clearly defined in his own mind, and that the advice is the inevitable fruit of that reason. When he works, let his effort, whatever it be, be characterized by intelligence, by a clear purpose to attain a clearly perceived end. Such a course will do more to honor the profession in the eyes of men than fine-spun theories, vague philosophies, and sonorous phrases of empty words. Such a course will embody and illustrate the fundamental principle of true ethics.

Am I met by the inquiry, "Shall no search be made, then, in the regions of mystery?" "Shall nothing be said or written but that which is clearly understood?" No such interdiction can be fairly deduced from what has been said. Search? Aye, search most diligently. Penetrate as far into the regions of the unknown as your boldest foot and keenest glance can go. Enter if possible into the barred chambers of occult wisdom and possess yourselves of her choicest arcana. Enter into the inner sanctuary where the richest stores of science are concealed and lay hold of them with firmest hand. But in the exciting quest forget not to discriminate carefully between treasure and tinsel, between the solid and the superficial, between the real and the seeming. And when the search is crowned with success, come forth again, bringing your treasure with you, and lay it on the common altar. To do thus is to honor one's self and to honor the profession in whose interest the labor is undertaken. This is ethics. To do less is to defraud one's self, and by just so much to defraud the profession, and this is an infraction of the great unwritten law which we are considering.

What I am urging is the creation of a goal towards which we shall press. In our personal relations that goal is the cultivation of mutual consideration; in professional work, the highest good of those committed to our care; in professional conversation, the clear expression of positive ideas; in professional life, the maintenance of personal honor; in professional study, the securance of valuable information;

in society relations, the devotion of one's best energies to the promotion of the general good; in the labor of scientific research, the exercise of that calm, persistent, wise discrimination that digs and *tests*, that gathers and *sifts*, so that golden grain and not weightless chaff may be the product.

Such is the privilege, such the duty of every intelligent man, *as a man;* of every faithful dentist, *as a dentist;* and the more steadfastly, the more vigorously, the more religiously he exercises this privilege and performs this duty, the more nearly will his life accord with the requirements and the spirit of the great *Unwritten Law of Dental Ethics.*

SECTION III.

Dental Literature and Nomenclature.

Report by W. H. ATKINSON, Chairman.

IN the report of this committee of last year there were two allusions which will form the connecting-link with this report. The first was to the nature of universology as the one all-inclusive science, from which all our technical notions of classification and nomenclature must hereafter be derived. The other was to language, as a remarkable and guiding instance of a branch of universal things so well understood and so thoroughly distributed (in its grammar, etc.), as to furnish a sort of model for the distribution and classification of all other departments of being.

Let us hold fast to these two guiding ideas, and proceed to lay the basis of classification and nomenclature on their broadest and most fundamental generalizations.

In the report of last year we gave illustrations of minute and particular nomenclature (punctits, punctids, etc.), in order to demonstrate the capacities of the new method in that range of things where, as histologists, we shall have the most occasion to employ it. We pass now to the opposite pole,—that of extreme generalization,—in order to establish a groundwork of method which shall be demonstrably adequate to embrace and sustain the whole system of possible discriminations of this sort, and so to prove that this is not merely *a* system, but *the* system to which we *must resort* if we would have anything which shall be thorough and exhaustive. Do not be afraid of technicalities, and even of novel and difficult technicalities, since to look for the founding of a system of nomenclature of universal application without new technicality would be as absurd as to demand of your cook to make an omelet without the breaking of any eggs.

We must also recall the fact that Alwato (ahl-wah-to) is the name of the new scientific language derived from universology, of which these new technicalities are merely *some of the words.*

Three departments of universal things will now be compared, with reference to their most general distribution of parts: First, the Cosmos, or world at large; second, Language, already alluded to as an epitome of the world, or as a little world distributed on the plan of the big world; and, third, the Human Body, as another little cosmos or world, also distributed upon the same universal principles.

A distinction is made, universologically, between the cosmos (albo) and the universe (alio). The cosmos means *whatever is*,—the aggregate of universal things—in so far as conceived of as an organized or embodied whole, or as an organism, and as capable, therefore, of distribution into parts in a manner like that in which we distribute language, or the human body, or any other organism. The universe is a word of larger but more indefinite meaning, and signifies *whatever is*, absolutely, or the aggregate of universal things, whether *cosmified* or organized, or diffusive and chaotic.

The three objects for present comparison are, then,—

1. Albo (ahl-bo), the Cosmos;
2. Wato (wah-to), Language; and,
3. Hobodo, the Human Body.

[Bodo is body. The prefix ho confines the meaning to the human sphere of things.]

First let us deal with Wato (language). This undergoes the well-known discrimination into (1) Parts (of speech), the basis of grammar; and (2) Elements (of sound), vowels and consonants, the basis of phonetics or phonology. There is here a noteworthy difference between parts and elements; but "parts" is here used, as we shall presently see, in a very extended and unusual sense.

There are usually reckoned (say) nine parts of speech. These can be, however, and are,—for universological purposes,—reduced to three (parts of speech of a more generic order). These are:

1. *Substantivoids* (including substantives, pronouns, and interjections,—the vocative with its compellative sign, etc.);
2. *Adjectivoids* (including adjectives, participles, and the articles); and,
3. *Connectives*, or *Relationoids* (including prepositions, conjunctions, and adverbs, which last are all reducible to a substantive in an oblique case, or to a substantive and preposition,—as, *surely* means *in a sure way*, etc.,—and so all oblique cases of substantives are inversely equal to adverbs).

The verb is in this distribution unprovided for. This is because it is a focalization, or totalization, of all the other parts of speech, or sums

them all up, or includes them all. All other verbs, except the verb *to be*,—the so-called *substantive verb*,—are reducible to this one (*to be*), joined or smelted in with a participle (or motic adjective). The so-called participle is always nothing else than a motic adjective, or adjective of motion (running, reading, etc.); and the so-called verbs runs, reads, etc., mean *is running*, *is reading*, etc., so that the great mass of the so-called verbs (all, indeed, but the single verb *to be*, *is*, *was*, etc.) are virtually adjective in character (except the *is*, *was*, or *were*, etc., which are parts of the verb *to be*).

But the essential part of every verb is this copula (*is*, *was*, *were*, *will be*, *etc.*), IS, or some other part of the verb *to be;* and this is known as the *substantive verb*, because it embodies the idea of *being*, which is also the character of the substantive. The verb is thus, therefore, from another point of view, a substantive (instead of being an adjective). Finally, the verb *to be* (really the only verb) is neither substantive nor adjective, but a peculiar kind of connective (or copula), joining the substantive and adjective in a proposition, as, JOHN IS SICK, and hence it is a *relationoid*, or, a word of relation; so that, from this third point of view, it may be rightly and tersely said that *there is but one verb, and that one is a conjunction.*

The verb is therefore the central rosette, or figure, of language, and is rather a peculiar epitome and *wholeness* of speech than a *part* of speech, like the others, though for convenience it may be reckoned as the tenth part of speech.

Language is the *expression* of the universal reason; the verb is the *totalized individual* of language. Hence the Latin *verb-um* renders the Greek *logos* (meaning both *speech* and *reason*), which is again "the *word*" of St. John, who affirms that "In the beginning was the Word, and the Word was with God; and the Word was God," meaning that the universal reason, expressed through the individual, is one and the same as God.

Passing to Albo (the cosmos, and this is alike true of alio, or the universe), there are three parts of being (in this same large sense of the word parts) which accord with the three grand parts of speech in this way:

1.	2.
ALBO.	WATO.
Three Parts of Being.	Three Parts of Speech (grand).
1. Aggregates (or things).	1. Substantivoids.
2. Properties.	2. Adjectivoids.
3. Relations.	3. Connectives (or relationoids).

In Alwato, these two parallel sets of discriminations appear under the following names, which clearly indicate, in the forms of the words, their inherent parallelism:

1.	2.
ALBOSO WARDZ.	WATOSO WARDZ.
1. Albo,bau,adīts.	1. Wato,bau,adīts.
2. Albo,mlau,adīts.	2. Wato,mlau,adīts.
3. Albo,sayiuts.	3. Wato,sayiuts.

Space does not admit of giving here a full account of the reasons for the particular formation of these words. By throwing off the prefixes by which they are confined, in meaning, to their particular spheres, they are generalized so as to be applicable to either of these and to all other spheres, thus,

1. Bau,a,dīts (bow-ah-deets).
2. Mlau,a,dīts (mlow-ah-deets).
3. Sa,yiuts (sah-yutes).

These, then, denote three very fundamental aspects of being (thing-like, property-like, and relation-like) in their most universal sense, and are root-words, prepared to be assigned by adding the necessary prefixes, which will assign them to whatsoever sphere.

Assigned to the human body (as one of the spheres of being), the prepared terms apply thus: Hobodo,bau,a,dīts signifies all the real objects, of whatsoever character, which go to the make-up of the human body; hobodo,mlau,a,dīts signifies the properties or attributes (qualities, as colors, sounds, smells, shapes, etc.) of the human body; and, hobodo,sa,yiuts signifies the connections or joinings of body with body (within the body), of part with part, of organ with organ, etc., but especially of the *whole* body to its environment, as the connection of *parts* belongs more especially to the category of *articulations*, subsequently to be noticed.

By this allusion to the Whole (in its individual epitome) we are reconducted to the verb, and its analogues in other spheres, of which the human body in its totality (hobodo,al) is one. Language, as *totalized*, is again redistributed, not now into "parts," but into elements; and so with the totality of the human body, etc.

Observe, then, that all the discriminations above treated of (except in this last allusion to wholeness) belong to the *elaborated* aspect of things, and not to the *elementary;* which is perceived readily if we advert to the parts of speech in language as belonging to grammar,

which pertains to the elaborismus (the elaborate domain) of language, and not to the elementismus (the region of *elementary* sounds: vowels and consonants). Let us next consider the elementismus of language, of the human body, and of universal things (albo or alio).

Recall, first, the fact that parts, in the phrase "parts of speech," does not mean parts in any ordinary sense, as fragments, for instance, of real things, but that all real things, collectively (or their substantive names), are, in this sense, only one of the parts of universal being, properties and relations being the other two parts, in the elaboroid or structural view of things. But in the elementary aspect these three discriminations appear in a distinctly new phase.

The lingual elements (or elements of language) are vowels and consonants (or, better, for present purposes, consonants and vowels). These may be classed as follows:

I.	*True Consonants; Hard Sounds;* "*Solids.*"				
	k,	t,	p,	(joint-like.)	
	g,	d,	b,	(bone-like.)	
II.	1. *Vowels.*				"*Soft-Solids.*"
	a, e, i, o, u.				
	2. *Ambigu's* (Half-vowels.)				
	h, y, w.				
III.	1. *Nasals.*				"*Liquids.*"
	ng, n, m.				
	2. *Oral Liquids.*				
	l, r.				

Correlated with the human body they reappear, thus:

1. Hobodo.		2. Wato.	
1. Bones and Joints—"*Articulations*"—"Solids."		1. True Consonants—"*Articulations*"—"Solids."	
2—1. Flesh-masses.	"Soft-Solids."	2—1. Vowels.	"Soft-Solids."
2—2. Viscera.		2—2. Ambigu's.	
3. "Fluid" Parts.		3. "Liquids."	

It is obvious that we are here on the road to the *anatomical* distribution of the human body, and its analogues, in language. Not only are consonants instinctively called "articulations," but the framework-words—written by consonants without vowels—in phonography are called, in the same way, "*skeleton* words."

The prior set of discriminations (elaborate) into aggregates and properties,—the motic properties, denoted by the participles, being

functional, or related to doing, and the aggregates being things, as agents or organs,—was, it may now be said, the *physiological* discrimination into organs and functions. (Observe that organ is not with any propriety an anatomical, but always a physiological, term.)

Finally, the wholeness aspect (*whole*-th=*health*) is hygiene. The proposition, or verb-locution, in language, is the lingual *individual*, equal to ihobodo, or the *individual* human body; the active voice (or vocation) being male, the passive, female, etc.

So we have here the basis of the fundamental discrimination in medical science into (1) Physiology, (2) Anatomy, and (3) Hygiene, and see the same discrimination extended, by implication and analogically, to language, and to all other domains of being. The fundamental pairings of discriminations within each are these:

In Physiology.	Organs.	Organology.
	Functions.	Functionology.
In Anatomy.	Bones.	Osteology.
	Flesh.	Carneology.
In Hygiene.	Male.	Sexology.—(Basis of Health.)
	Female.	

SECTION II.

DENTAL EDUCATION.

REPORT BY J. N. CROUSE, CHAIRMAN.

IN presenting the report on "Dental Education," the Section must necessarily repeat many ideas and propositions which have been presented in reports of previous years, for the reason that many reforms which were advocated in those reports have not been adopted, and it is only by continuing to call attention to needed reforms that we hope to secure progress.

It is noticeable that nearly all members of this Section who have taken any part in its proceedings have emphasized this point: that a better preliminary education on the part of the student should be insisted upon before he is accepted as a student of dentistry. The Section would urge that some standard of preliminary education for students should be fixed by this Association, and by it recommended to the colleges, in the hope that they will adopt it, and thereby secure unanimity of action in this direction. Such action on the part of the Association would at least stimulate progress in this direction.

It is the opinion of the Section that the student, in addition to the knowledge and mental discipline acquired by pursuing such a course of study as is usually embraced in the curriculum of our best academies, should have some office-training and a preparatory course of reading, previous to attending lectures. This point is fully elaborated in another paper which will be read.

With reference to the colleges, the Section would earnestly suggest that they should insist upon a more rigid preliminary examination of students, both as to their character and mental acquirements, and that more care should be exercised, especially in their examination for graduation. This latter could be best secured by placing the examinations of students in the hands of regents selected from the best men in the profession, thus giving the profession a direct oversight and interest in the work of the colleges.

Upon the recommendation of this Section, the Association last year adopted the following resolutions:

"*Resolved*, That hereafter no dental college shall be entitled to representation in this Association that does not require a good English education as a preliminary qualification for its matriculants, to be ascertained by examination.

"*Resolved*, That the colleges shall hereafter grant no diplomas except to those who attend at least two full courses of lectures, excepting that practitioners of dentistry who present satisfactory evidence of having entered upon practice prior to July 1, 1875, and of having continuously followed the same from that date, shall, until July 1, 1885, be entitled to present themselves for examination for the dental degree after attending one course of lectures in a duly-recognized dental school.

"*Resolved*, That no dental college shall be eligible to representation in this Association that does not in its next annual announcement give notice of its adoption of this limit to the conferring of the degree."

The Section are now unanimously of the opinion that a higher standard of education would be attained if all the schools would require attendance upon two full courses of lectures before allowing the student to come forward for examination for graduation. In view of this fact, the Section would recommend the adoption by this Association of the following resolution:

Resolved, That in order to secure representation in this Association, dental colleges must, subsequent to October 1, 1881, require all students entering therein to take two full courses of lectures previous to coming forward for examination for graduation, and must also state these conditions in their next annual announcement."

[This resolution was adopted. See minutes.—PUB. COM.]

So far as the Section have been able to ascertain, the following schools have substantially followed the suggestions contained in the resolutions adopted last year:

The Dental Department of the University of Pennsylvania, the Dental Department of Vanderbilt University, the Boston Dental College, and the Western Dental College. The Dental School of Harvard University and the Dental Department of Michigan University were already carrying out the reforms referred to.

The Section feel confident that the respectable schools that have not already complied with the views of this Association, as expressed in the resolutions adopted last year, will surely do so soon, for no school that desires to have the educational standard higher can reasonably refuse to assist in establishing these much-needed reforms.

As to those schools that are not reputable,—which are a positive hindrance to educational advancement,—their methods should be so thoroughly exposed as to render them harmless.

The question, "is dentistry a specialty of medicine?" is again brought to your attention, and both sides are presented in different papers which will be read, rendering unnecessary the recapitulation of the arguments in this report.

SECTION II.—Continued.

SUPPLEMENTAL REPORT ON EDUCATION, BY T. W. BROPHY, OF THE SECTION.

ARTICLE III. of the code of ethics of this Association states: "Dental surgery is a specialty in medical science. Physicians and dentists should both bear this in mind."

Let us see whether a man who is a graduate from a dental college, but not a graduate in medicine, is entitled to the name of a specialist in medical science in the same relation that other medical specialists are. The time has not, nor will it ever come, when the medical profession will recognize individuals or a body of men as medical specialists, no matter how eminent and scientific they may be, unless they are graduates in medicine,—in short, medical men. Indeed, it would be as unreasonable for dermatologists, ophthalmologists, gynecologists, or other recognized medical specialists, to teach their departments, each as an independent profession, and expect to be called medical specialists, as it is to call the dental graduate, much less the man who has not received a dental college education, a specialist in medical science. A medical specialist must be *medically educated*, after which he may pursue any department of medicine which his inclinations or tastes may determine.

I do not claim that a man who graduates from a medical college is competent to enter upon the practice of dentistry without special training under efficient dental teachers. Neither do I claim that a graduate in medicine is competent to enter upon the practice of ophthalmology, or any other department of medicine, without long, careful, and well-directed special study.

There is but one way by which dentists can become medical

specialists, and that is by acquiring the broad foundation of a medical education, upon which every medical specialty must be based, the specialty of dental surgery included. Therefore the members of this Association should require their students to attend the prescribed course of lectures in a medical college, and graduate as Doctors of Medicine, before entering upon the specialty of dental surgery.

Unless this Association adopts this report, or such portion as requires all members to demand that their students graduate in medicine, or adopt some measure by which this clause may be carried out, I believe that it will be to our credit as a society to expunge from the code of ethics the clause, "Dental surgery is a specialty in medical science."

SECTION II.—Continued.

SUPPLEMENTAL REPORT ON EDUCATION, BY L. C. INGERSOLL, OF THE SECTION.

THE growth of the sentiment regarding a higher dental education can be traced to two sources: one, social science, the other, moral science. Out of social science springs the desire that the profession should rank higher in the social scale,—that it should stand higher in public estimation when compared with other professions. Out of moral science springs the philanthropic desire that the profession should be able to do better service for mankind in the prevention and relief of suffering, and in promoting health and long life. In the mind of one the social element is most prominent; in the mind of another the philanthropic element; while both alike look to education as the only legitimate means for realizing their desires. One looks to a more extended, thorough, and complete education of the man *in* his calling as a dentist; the other looks to a more thorough education of the man *out* of his calling, and before he enters upon his calling,—to that education which is designed to develop and train the mind as preparatory to those special studies which pertain to the dental calling.

Professional studies alone may secure in large measure the philanthropic aims of the profession, but will not alone secure the social standing we desire. Important and necessary service rendered to mankind is not the ground of our social claims. The servant class

render vastly important and necessary service to mankind, yet their social standing is low.

Civilized society the world over is stratified. Birth, caste, wealth, education, and political preferment mark the lines of the different strata. In this country wealth, education, and politics draw the dividing lines. In spite of all doctrines of equality proclaimed by constitutions, political platforms, creeds, sermons, and humanitarian schools, *higher* and *lower* are meaning terms, and indicate different degrees in the social rank. Equality of the human race is only known in embryonic and infantile life. The born king and the born serf are on an equality at the mother's breast, except for their clothes. The wise man and the fool sat on their mother's knee equals, so far as sense or science knew. Development makes them to differ, and development is education. *E duco*, a primitive form of words, from which our word "education" is derived, signifies a leading forth of the attributes, functions, and powers of man's entire being, and begins, in its most important sense, at birth. Air educates the lungs; food, the stomach; light, the eye; form and firmness of objects educates the sense of touch; sound educates the ear; sight, touch, and hearing develop thought; differences educate the faculty of comparison; repetition educates the memory; reflection, the reason; so on and on through the entire range of powers and functions embraced in man's physical and spiritual nature,—body- and mind-nature. Whenever, then, we talk of education, let us keep in mind this primary idea of *development*, of leading forth powers and functions to an objective activity. In the broad sense, the term education may as strictly be applied to man's physical nature as to his mental. When applied to the mental, it signifies a development of or a leading forth of the powers of the mind in active relationship towards their appropriate objects. It means activity and increase of power to act. It means advancing from less to greater power. It means increase of mind-resources.

Compare now this definition of education with the popular notion that education consists chiefly in storing the memory with long lines of facts, just as you force into the mind of a child that long line of unrelated letters we call the alphabet. The difference is just the difference between a store-house and a machine-shop. In the one all the material lies dead; in the other all the material is in the active process of being worked up to appear in new forms.

To memorize facts and propositions is a very important part of education; it is gathering together the material. It is the first step

in advanced culture, just as memorizing the alphabet is the first step in primary culture. But the alphabet, however thoroughly memorized, contains not a single idea. *Letters* must be put into relationship with each other before they can become meaning symbols of ideas. So, memorized facts and principles must be put in relationship to each other before they can have in them the educating element, in the better sense.

The mind as a receptacle of such material as we call knowledge, and the mind as a power capable of working up this material for practical use, are two different conceptions.

Every rule of the Latin grammar may be thoroughly memorized, but, for lack of the right sort of training, the pupil may not be able to apply these rules in the formation of a single Latin sentence. One may memorize a bookful of medical formulas and recipes, and be wholly incompetent to practice medicine.

In this enlightened age the world should have got beyond the idea that a man may start out from anywhere, at any period of his life, in any calling he may choose, gather up a bundle of facts and throw them out by the fist-full into the face of society, and pass for an educated man. Education means mental development, mental power, mind-force, and not an aggregation of scientific facts and fancies poured into the mind as a passive receptacle.

Every enlightened educator conceives it his business to train the mind to an active exercise of its faculties. Every mental endowment is put under discipline. Each faculty in its turn, observation, memory, reflection, reason, judgment, all come under the master's hand for training.

A man thus educated cannot handle anything without observing its nature; cannot see anything without reflecting on its uses; cannot listen to the enunciation of a principle without applying it; cannot hear a proposition without penetrating its meaning; cannot enter the field of argument and stop short of logical conclusions. This habit of mind is the key to knowledge,—theoretical, practical, and scientific.

Lead forth a mind thus trained into any of the practical ways of life,—into politics, religion, philosophy, science, commerce, trade, or mechanics,—and the conquest is easy and certain.

I have written thus much about education in a general sense, education as a primal idea, so as to be able to say with some clearness and force that a little specialized knowledge is *not education.*

To begin education in the dental college and end education in the dental office can never give to the profession the educational rank,

can never raise dentistry to the rank of the learned professions. General education will; special education will not. When we look forward to and hope for the elevation of the dental profession, we must seek recruits among the better educated class.

It is the mind and not the fingers that makes the man. It is the full-rounded mental development, and not mere manual dexterity, that creates the superiority of man among his fellows.

We are now prepared to consider the question, What is special education, or education professionally considered?

First, it means *education*. It implies the possession of mind with mind-capital,—mind-forces developed and active. The gaining of a special education means the application of one's native and acquired mental powers to some particular calling. It is taking the mind-capital of which one comes possessed and putting it to some profitable use, to some special work demanded by civilized society, in conducting which thought and learning constitute the chief capital. Success, then, depends upon having such capital to put into it. It is but a common-sense proposition in any financial business that a young man must first acquire capital before he can safely make an investment. So, mind-capital must first be acquired before a professional education can even be entered upon with any hope of success.

As regards the science of dentistry, its basal principles are as intricate as the nature of man, and as hidden as the forces of nature. They cannot be well understood and successfully applied without learning. Facts and principles are confusing to an untrained mind. It knows not how to arrange them or how to use them. Thus it will appear that one year of study for any professional calling with a mind well disciplined by a systematic education is better than two years of study with a mind undisciplined. More than that: the untrained mind studies *much* to no profit, comprehends little and acquires less, for each little is but a part of an unknown whole.

If, then, we would raise the dental profession in social rank and secure best its philanthropic aims, it can only be done by a deep and broad culture, such as educated men who have already acquired rank and position will recognize and respect. A skillful hand without the cultured brain can never make dentistry what it deserves to be. The habit of thought and investigation is far more important to the student of dentistry than any acquired skill of hand. Dean Stanley, during his recent visit to this country, said of the learned Dr. Robinson and his travels in Palestine: "Dr. Robinson had an eye capable of observ-

ing what was worth his attention, and a mind strong enough to enable him to put his impressions into a readable form. This excellence is due to Dr. Robinson's having *eyes to observe*, while others have had eyes *not to observe*."

It is this education of the faculties that qualifies a man to get knowledge. To know is first to have the faculty of knowing. To know dentistry is first to gain the capacity to know it.

In this view of the subject the elevation of the rank of the dental profession depends far less upon the curriculum of study in a dental college than upon the curriculum of study before entering the dental college.

It is conceived by some, perhaps by very many, that the preliminary course of study as a qualification for the study of dentistry should be a full medical course. However great a store-house of scientific facts the medical school may be, the amount of scientific knowledge the medical student brings away as a foundation on which to build the systematic structure of practical dental science depends upon his mental qualifications. If he goes into the medical school an ignorant, untrained boy, he comes out such. If he has never had reason and judgment cultivated, and has not acquired a quick apprehension of principles and a discernment of related facts, I would much rather the student should spend two years in a well-equipped academy than two years in a medical school as preparatory to entering upon the study of dentistry.

Is dentistry a specialty of medicine? I answer yes, and I answer no, for the question will admit of both an affirmative and a negative answer. If by medicine is meant that broad science which teaches the nature, functions, and whatever else is known and knowable of man's entire physical organism, I will accept the affirmative answer. Dentistry *is* a specialty of that broad and comprehensive science which brings within its scope the whole of man's physical nature, for dentistry pertains to a *part* of man's physical nature. It has for its purpose the investigation of a *part* of the human structure, the unfolding of the laws that control the development of the structure and lesions to which it is subject.

When the science of medicine is spoken of in its fullest and most expanded sense, it may be made to include dentistry and all other specialties that make any part of the physical man a subject for scientific research.

But there is no such use of the word in common parlance. The term medicine, as applied to a department of science, unless otherwise specifically defined, must be understood in its popular sense, and *is* generally so understood. In this sense the term medicine means the teachings of the medical schools, medical text-books, and medical literature,—*that* science which is taught as a basis of the medical practice, and is represented by the medical faculty, and by the recognized medical profession of this country. Medicine in the broad sense is *anthropology*, the science of man. Of this science medicine, as popularly understood, is itself a *specialty*, in the same sense that dentistry is a specialty. Both draw their facts from the same broad field, man's physical nature.

The phrase *specialty of* means *part of*, or a *department of*. Who can pretend that it has ever been even the *smallest part* of medical teaching in the schools of medicine to qualify the student for the practice of dentistry?

Who can pretend that there is to be found anywhere in medical text-books, or in general medical literature, any basis on which to build a dental practice? Who can pretend that there is anywhere in this country a medical faculty who by their college lectures, supplemented by the private teaching of the best strictly medical preceptor, could ever qualify a student for the practice of dentistry? By what authority, then, is dentistry to be declared a *part of* medicine, a *department of* medicine, or a *specialty of* medicine?

If dentistry has been forever ignored by the schools of medicine; if its paternity cannot be traced to college faculties and the medical profession; if dentistry has become an established science from sources outside the medical faculty and medical schools; if, after centuries of medical teaching in well-endowed medical schools, dentistry has been compelled in the nineteenth century to establish its own schools and open new fountains of knowledge; if it has established a profession based on scientific facts never known to the medical profession, and has correlated these facts into a science and proved it by a systematic practice—demonstrated not on the cadaver but on the living subject—we should be ashamed to seek its paternity where it is not to be found, merely for the sake of honorable mention. It is a sign of feebleness and weakness to ask for the mantle of a time-honored ancestry to cover us. Much better for the dental profession to claim that we came forth, Adam-like, out of virgin soil.

Medicine, though not the recognized father of dentistry, may rightly be esteemed its older brother, having the same ancestry. Far back

in the genesis of science, out of the womb of the remote past, medicine and dentistry were born twins. True, medicine, like Esau, was born a little first; but dentistry, like Jacob, came forth having fast hold of Esau's heel. Medicine being thus the *first-born* was considered the *proper* child, and was nursed at the breast of queens and fed on the best milk of the passing ages; while dentistry was left, like Romulus and Remus, to be nursed by a wolf. When medicine had come to be centuries old, dentistry was still in swaddling bands. If in neither ancient nor modern times medicine and dentistry have stood in any other relation to each other than that of independent brotherhood, it is a confessed weakness in the day of our strength and honorable standing to ask that medicine shall belie the relationship and all past history even to own a worthy progeny.

DISCUSSION.

Dr. ALLPORT: So much has been written and said in regard to the subject of dental education, that to some it has become threadbare and hackneyed; but as correct practice must depend upon the proper education and training of those who practice, we ought never to tire of expressing ourselves in such a way that the best thoughts upon this subject will be well understood and acted upon, not only by the younger members now in practice, but especially by those who are about entering our profession as a life-calling. Some are inclined to censure our colleges for the lax manner in which they give instruction and their low standard of graduation; but in this, as in other matters, it is easier to blame than to mark out a course of improvement. While it is clear, in my mind, that the time has come for a changed mode of instruction and improved qualification, too great thanks cannot be expressed for what our colleges have so far accomplished. To my mind, nothing is so much needed at the present time as an absolute division in the practice of dentistry. Those who are engaged in artificial dentistry should be educated in that department and follow it exclusively, and those engaged in dental or oral surgery should be educated in and follow that as a distinct calling.

A medical education, supplemented by special instruction in dental surgery, must be the foundation for correct practice in that branch of the profession, and a diploma from a respectable medical college should be the first requisite for matriculation in a dental college, or special instruction in that department. No one can doubt that this

system would better qualify the oral surgeon for the practice of his specialty than the *partial* medical education now in vogue in our dental colleges. None feel the need of this so much as the older members who entered upon the practice of their calling without it. When this mode of instruction and change is suggested to teachers in our colleges, the objections urged are that more time will be required, and that it will be difficult to get young men to adopt it, and that the community expect the dentist to do all that is required, whether it be dental surgery or artificial dentistry, and that people will not go to one practitioner for services in the former department and to another for the latter. The first objection is good, and will continue to hold good so long as both branches of the profession are included in the same course of instruction and students are required to qualify themselves in both branches before graduating in either. If the time devoted to the teaching of mechanical dentistry in our colleges were employed in acquiring a thorough medical education, supplemented by special instruction in oral and dental surgery, but little more time would be needed to thoroughly qualify students to practice dental surgery as a medical specialty than is now taken to partially qualify them to practice in both departments. The advantages gained by this change would be so great that I cannot see why the objection urged is valid.

If dental surgery is a specialty in medical practice, as we are so apt to claim, surely the foundation for its practice should be laid in the broad and most approved teachings of that science, which is best secured from standard medical text-books and in regularly-organized and fully-equipped medical colleges. A knowledge of the general principles of law is essential to the intelligent practice of criminal, admiralty, or any other special branch of the legal profession. No one would be allowed to practice in any of these departments without first passing an examination in the fundamental principles of that science. Nor should any one be regarded as a special practitioner in any department of medicine without careful and thorough teaching in the basic principles of that science.

No one can make a good, practical artificial dentist without first receiving careful and thorough instruction, not only in the principles of mechanism, but in the essential principles of art. Complaint is justly made of the low standard of artificial dentistry; but considering the meagre instructions given in our colleges, my wonder is not that the standard maintained is so low, but that it is as high as it is.

To follow the calling of a mechanical or artificial dentist properly,

the practitioner should have a reasonable knowledge of the anatomy of the parts about which he works, as well as of chemistry, including metallurgy and the laws that govern mechanics; and he should be specially instructed in applying these principles in this, one of the most difficult branches of mechanics. A good mechanical dentist must understand how to put up teeth on rubber, celluloid, gold, the various cast metals, and the finest of all artificial dentistry, porcelain continuous-gum work on platinum. He should be able to so adapt these various kinds of work to meet the exigencies of cases presented, that, in a mechanical sense, the greatest benefits possible may be derived in masticating. It will not be maintained by teachers in our dental colleges that the instruction given is sufficient to thoroughly qualify graduates to so put up work by these various methods as to give to their patients the greatest benefits attainable. But little attention is paid to any kind of work except rubber and celluloid, the cheapest and lowest grade of dental plates known. Few, indeed, of these graduates can do acceptable work on gold, much less platinum. And too, too many of our teachers are as poorly qualified to put up these higher grades of work as are the graduates they send forth. The result of this inferior instruction is a very low grade of mechanical dentistry, and it will exist just as long as the present mode of teaching and mixed practice prevails. No man can learn to make a good pair of boots or shoes, or a set of harness, or even a shirt, in six months' teaching; and yet our teachers will hardly claim that more than this length of time is devoted to the teaching of mechanical dentistry in our colleges. Regarding this branch of our practice simply as a mechanical calling, the man does not live who can thoroughly qualify himself to render to his patients the service they are entitled to, with anything less than two years of the most careful practical instruction. But a set of artificial teeth should not be regarded simply as a mechanical fixture. Their proper construction requires the application of some of the higher principles in art. Artistically considered, a set of artificial teeth should be so adapted in color to the age and complexion of the wearer, in size and contour to the shape and expression of the face, as to attract no more attention than does the nose, the eye, or the hair. The fact that they are artificial should be concealed, and this can be done by no one without a knowledge of contour and the proper blending and harmony of colors, acquired only by a careful study of the principles involved in art. But the fact is, that however closely the manufacturer of artificial teeth may copy nature in those thrown upon the market, the

great lack of artistic knowledge among a large majority of dentists renders most sets of artificial teeth, in the mouth, conspicuous advertisements of the fact that the dentist who put them in is as ignorant of art as he is of the contents of the moon. And if students in mechanical dentistry would devote to art-study the time now spent in procuring a partial medical education in our dental colleges, that calling would soon assume its proper place among the higher branches of professional art.

The other objection to this division of practice is equally untenable; for people have but to be educated in the matter to learn that the greatest skill can only be obtained from those who devote their study and time to the perfection and practice of these departments separately. When we have properly qualified mechanical dentists, and they have offices by themselves for the exclusive practice of their calling, the dental surgeon will not be required to do this class of work, any more than the surgeon is to make artificial limbs or eyes.

If this question could be properly discussed by the great educator of the people, the newspaper press of the country, the public would soon become so educated upon the subject that they would as soon think of going to the general surgeon for artificial limbs as to the dental surgeon for artificial teeth: and certainly no one would think of going to the maker of artificial limbs for surgery. The greatest excellence is always gained by subdivision of labor, and in no field could we look with greater hope for development and skill, by division, than in the study and practice of the two departments of dentistry.

Dr. Morgan: Perhaps ten or fifteen years ago, when this matter was first mooted, after some immature thought upon the subject, I went upon the record as in favor of the divorcement of the two branches. I have since then had cause to change my opinion, and the more I think of it the more impossible it seems to be to accomplish the object; there is such an interlacing of the two that it seems to me impracticable for it ever to be brought about. The mechanical branch of dentistry so interlocks with operative dentistry or oral surgery, in the correction of irregularities of teeth, for instance, that it seems to me an impossibility to separate them. The dental surgeon who undertakes to correct a set of irregular teeth should not only be able to devise in his own mind the means by which he proposes to accomplish it, but he should be able to construct his fixtures for that purpose. I take it that the man who desires the accomplishment of a certain end, and understands the means by which it can be done, can, if he has good mechanical skill, produce the apparatus

needed in greater perfection and with better adaptation than can the outside mechanic who does not understand the principles upon which it is to be applied; in other words, that the dentist who understands the construction of appliances can make a better one for the correction of irregularities than it is possible for any mere mechanic to produce.

Again, you can no more separate artificial dentistry from dental surgery generally than you can separate medicine from the practice of dentistry. None of us claim to practice medicine, and yet constantly cases come into our hands which require us to turn to the medical art and apply its principles in our practice. For instance, a patient comes into your office in trouble with, perhaps, an incipient abscess. You look at the case, examine your patient, and find his general condition to evince a tendency to inflammation. You do not think in such a case as that of calling in a regular physician to give him general treatment, but with some mild treatment you send him away, with the expectation of seeing him come the next day in better condition. All of us are compelled from time to time to administer medicine addressed to the general system. It is so inconvenient and sometimes so impossible to make medical men understand the condition of the patient, that you are necessarily compelled to administer medicine yourself.

In the same way it seems to me these two branches of dentistry are so interlocked with each other that it is impossible to separate them. Besides, sometimes artificial substitutes have to be applied in mouths that are in a pathological condition. What are you going to do in such cases? Are you going to turn your patient over to an ordinary mechanic who knows nothing of the condition the mouth is in, who understands nothing of pathology?

That is not the way an intelligent mechanical dentist performs his duties. It seems to me that the two branches necessarily interlace, and that dental education should be based upon medical science, and then the principles of mechanics as far as they apply should be studied, and the two blended together for the accomplishment of the highest results.

Dr. Buckingham: I take the ground exactly that Dr. Morgan has just taken, that the two branches are so interlocked with each other that it is impossible to separate one from the other.

It is very evident, from what Dr. Allport has said, that he has not considered what is and what should be taught in the artificial branch. It is not merely the manipulative part of making a set of teeth, the

mere mechanical operation of putting them together, but there are other things that should be taught to the mechanical dentist.

In that branch the principles of mechanics are taught, and not only those principles, but the expressions of the face are taught. We had quite a number of lectures in our college upon the anatomy of expression,—the different muscles that are brought into play. We have also lectures upon the anatomy and structure of the voice. These all come in, as well as the expressions of the face. There is no place that this can be taught more appropriately than in some public institution. If you choose to separate the profession and make a mechanical branch and an operative branch, it would be very well; but they are not so extended but that they can be studied together, and, as Dr. Morgan said, they must necessarily interlock and go together in practice.

We do not profess to be able to make a man thoroughly perfect in the operative branch and turn him out in the condition of a man who has been in the practice thirty years. We want to teach him the principles, teach him why he saves teeth, and how it is to be done; and when he has learned that he goes into practice.

We talked yesterday morning about packing gold and putting it in, one piece after another. There was no principle involved in it,—there was no reason why one saved the teeth better than the other, except that one might be more perfectly put in than the other. It was a mere mechanical discussion throughout the whole. What we want to teach students is the principles as well as the practice, as far as we can, because you cannot make any man perfect in a very short time. Teach a man the principles of law, and he goes to a court and is admitted as a practitioner; but no one will suppose that the young lawyer is as competent as Daniel Webster after he had been fifty years in practice. A young minister will go out from his school, and he comes into the pulpit and delivers a good sermon; but no one believes that man to be the same as he will be forty or fifty years after; and yet it is expected that the dental student will go out with all the accomplishments of his profession. The schools are but the nursery; and I will put it to any reasonable man if any school is not better than most private offices we have to-day.

We know it is the case that the very best dentists we have do not take students, and where are the students to go? Dentistry is growing gradually. Men who are around me now, who saw dental colleges twenty or thirty years ago and compare them with what they are at the present time, will be surprised at their progress. They

are now advancing dentistry as fast as any other of the branches of science. The system is not perfect, and will not be perfect in our generation; but we are possibly growing faster than any other profession that is now in existence.

I am opposed to this process of separating, and I am opposed to another matter. There was a little article I saw at the head of a paper the other day that struck me very forcibly: "If you want any information about any kind of business, go to somebody that never was in it." There is no business in the world but that there are surrounding persons who can tell how much that business might have been improved if only some two or three things had been adopted.

The field of dental education is open wide. We are doing all we can, and we want the sympathy of the profession. We have got nothing but discouragement from these conventions all around.

They have found fault with us. They pick out every little flaw, and many things from reports outside that were not true. They never come to see us with one word of encouragement, they never give us one dollar of assistance, and yet they come here and complain about us for doing bad work. It is not fair. Some of us have devoted the greater portion of our lives,—twenty-eight years have I attempted to teach dentistry, and to do the best I could by it,—and this is all the satisfaction we get. It is not money. Everybody knows we do not expect to get money. If we do wrong, come to us kindly as you would to a brother, according to the scriptural rule, and show us wherein we are doing wrong, and then advise with us, and we will do very much better; but if you scold, we get crooked, and don't do any better than we did before.

If we were to build up a model student, and had the privilege of educating him before he came into the college, we should probably give him a very much better dental education than we now do. We must take the material that we can get. They accuse us of turning out material that is not good. We have many men who prove to be humbugs after they get out. Does not every institution in the country, medical, theological, and everything else, contain men that are naturally born quacks, and will be quacks all through, and some of the greatest quacks are those that are well posted!

We cannot control a man after he leaves college. Give us encouragement, and let us work and do the best we can.

Dr. Stockton: I do not think it is quite true that we come here to find fault with dental colleges. It has been said that our profes-

sion owes more to-day to dental colleges than to anything else. I think that is true. There is one thing where I think there is a wrong. Dental colleges are not responsible for it, but I think we as dentists are. There is a law in nearly all our States regulating the practice of dentistry, and there are more coming into the profession through the State examining boards, I think, than almost any other way. The general education of the young men coming before examining boards is not such, in a large majority of the cases, as to qualify them for dentists; and, too, the examiners in many cases have not that practical experience in making examinations that will enable them to ascertain whether these young men are qualified or not. Some of the examining boards do not require any really practical examination. Some who come into the profession in this way get in by the "skin of their teeth," and then they "skin" the teeth of their patients. I think that is the great trouble in dentistry, that so many are coming into the profession through examining boards, I may say through the back door, instead of going to the colleges and coming through them and being "men among men."

If they could all go to college and stay there two years, I tell you it would be better for them; there is no doubt about it. They cannot go through,—I do not care how little the professors know,—they cannot stay there for two years and hear the lectures on the different subjects unless they are made the better for it, and I think the wisest thing that can be done is for us to put our discouragement on these examining boards.

I know of young men who have passed the examining boards who cannot write a sentence correctly, and yet they are recognized as dentists by the law of the land. Our dental colleges should be sustained, in order to bring our professional standard yet higher. I am glad this preliminary education has been talked of. The higher the education of the man when he enters dentistry the better dentist he will make, and the more useful citizen, too, will he make in the community.

Dr. Moore: Much has been said in relation to our dental colleges, and as Dr. Buckingham has very truly remarked, they have not received that encouragement to which they are entitled. While I do not claim that they are perfect as they now exist, yet in reviewing the history of the dental profession for the past fifty years, noting its unparalleled progress and its vast influence of to-day, as compared with that of a few short years ago, we are led to inquire, to what can be imputed this stupendous growth, strength, and influence, if it

be not to the dental colleges? You cannot accredit it to anything else. True, we acquire much knowledge through dental associations, periodical literature, and in various other ways, but the majority of us receive our first impulses to move to a higher standard from the dental colleges.

The principal reason why colleges turn out bad or indifferent men as practitioners arises from the fact that they have bad or indifferent material with which to work. Since a majority of the best men in the profession refuse to take students, it stands to reason that, as a general rule, they (the students) come to the colleges through a lower grade of operators, and in many instances are devoid of a proper education. So let us not pull down these institutions of learning that have done so much good, but rather foster their interests, and encourage them to higher attainments by sending to them only WELL-EDUCATED, COMPETENT, and REFINED students.

As Dr. Stockton has remarked, a great many States have dental boards. Now, in our State (South Carolina) we have a law regulating the practice of dentistry, and a board of dental examiners, of which I have been a member for the past five years, during which time we have not granted a permanent certificate to any one. We have pursued the plan of granting a temporary license to practice until the opening of the colleges, and advise the licensees to attend lectures and perfect themselves. And I believe if this course were adopted by all other State boards of dental examiners it would be found the wisest, because a man who has not availed himself of every opportunity of acquiring all the knowledge that is attainable of a profession which he intends to practice has no right to a license to practice that profession, be it dentistry, medicine, or anything else.

Dr. TEMPLETON: I have heard nothing practical suggested to remedy the state of things in the dental profession at the present time. I think Dr. Buckingham spoke the truth when he said the colleges have to take such material as is sent to them. What is the reason that such material is sent? All over this country dentists are taking into their offices boys to attend to the drudgery and act as assistants. Finally these boys take a notion that they would like to become dentists, and if they go to dental colleges, having been taken into the office without any qualification or preliminary education, they will be graduated without having had the proper foundation laid.

How are you going to remedy this? How many local organizations have any rules or regulations restricting their members? I

would ask, can a young man enter the office of any attorney in the city of Boston without passing an examination as to his qualifications —whether he will be accepted as a student? I think not.

I know it is so in our city, and it is also true in the medical profession in all the cities. A young man cannot become a student in the office of any physician without passing an examination in regard to his literary qualifications.

For three years I have advocated this idea in our own local society, and a little over a year ago I succeeded in having a committee appointed to draft resolutions, which were adopted by our association, which provide for an examination of students in certain branches before their admission as students.

I have had several applications from young men to become students, and in the last two or three years I have rejected five or six because I thought their educational qualifications were not sufficient. One young man came to me and wanted to know the terms on which he could be taken as a student. I told him before we talked about terms I wanted to know as to his education. He said he thought he had a pretty good education, and told me where he went to school. I asked him what he had studied. He said reading, grammar, arithmetic, and geography. I asked him if he had any means by which he could obtain a better education. He said he thought he had. I advised him to go to school two or three years. He did not like that, and did not ask me anything more about terms. That young man went to Philadelphia and attended two courses of lectures, came up for graduation, and failed to graduate.

I had another application. A young man came to me and I asked him the same question; told him I thought he had better spend three or four years attending some good school, study the languages and some of the sciences, and then, if he wished to become a dentist, he was still young enough to begin, and I thought he would be much further ahead at the end of ten years than if he did not take that course. My advice was too much for him. That young man in sixteen months afterwards came home with a diploma, and is now practicing in the city of Pittsburg.

The following are the resolutions to which I referred:

WHEREAS, The profession of dentistry now suffers and has suffered in the past from the empiricism of many of its practitioners; and

WHEREAS, The dentist occupies the position of a public teacher; his education should be such as to enable him to give a satisfactory and scientific reason for what he does or proposes to do; therefore,

Resolved, First. That an applicant for the position of student in the office of any member of this association shall not be less than eighteen years of age, be of good moral character, and shall furnish satisfactory testimonials of the same.

Second. A diploma from any chartered literary institution shall be deemed sufficient evidence of an applicant's preliminary educational qualifications.

Third. The minimum preliminary educational qualifications shall be a thorough knowledge of orthography, reading, writing, arithmetic, grammar, and geography, together with a knowledge of the Latin grammar, and ability to read and translate a selection from any of the first five books of Cæsar's Commentaries.

Fourth. That an examining board, composed of three active members of this association, be elected at each annual meeting. The duty of said board shall be to examine all applicants for admission as students to members of this association. After examination of an applicant each member of this board will be entitled to ten votes, the applicant to receive twenty votes to entitle him to become a student.

Dr. BARRETT: I desire to say a few words concerning the connection between medicine and dentistry. It is useless for us to attempt to strut about in borrowed plumes. We can deceive nobody. Let us be honest and look the matter squarely in the face. Because the teeth are a part of the human anatomy, and a certain class of persons perform certain operations upon them, or make appliances for their cure or comfort, shall these therefore be classed as medical men? do they thereby become members of an old and venerated profession? If so, then may shoemakers on the same grounds claim admittance to the profession. If so, there *is* no medical profession, for old-established landmarks are at this one fell swoop broken down. It would be pleasing to us and flattering to our vanity could we thus cheaply earn so valued a privilege, and thus quickly secure a professional standing which physicians have spent years in gaining. Every crossroads peripatetic tooth-tinker a member of the medical profession! Why, of what are we thinking? Are doctors thus easily made? I tell you there is but one door of admission into medicine, and that is the front door of a reputable medical college. Medicine acknowledges but one form of credential, and that is an honestly-earned medical diploma. Any affiliation which we may gain, notwithstanding a similarity in practice, must be by first becoming medical men ourselves. We cannot practice a specialty *in medicine* except we first qualify for the practice of the general science in which we desire to become specialists. Will an ophthalmologist, a gynecologist, a surgeon, be acknowledged by medical men if he attempts the practice of his specialty before he has qualified in general medicine? And should we as dentists claim what is accorded to no other class

of men, even though they practice a specialty much more nearly related than is ours? We must take higher ground. We should scorn to attempt this sneaking burglary into an honorable profession. If we are to be medical men, let us each and every one secure the proper credentials. Then there will be no caviling at our claims to recognition. When we have passed the full curriculum of medical schools and secured an honorable place in medicine, we may *then* go out in any specialty we may choose and retain our standing. We may then claim to be specialists *in medicine*, but nothing short of this can make us so.

Our dental colleges have done a wonderful work. I yield to no man precedence in giving honor to our schools, but they are not what they might,—what they ought to be. Nor are our literary, our medical colleges yet perfect. It is sufficient encouragement, however, to know that they are improving every day, and the fact that the condition of our dental schools is a matter of much anxiety to the thinking part of the profession, that one section of our most important society is given up to the consideration of the state of education, is ample proof that the profession is not satisfied, but desires to make yet further advancement. We are rising, step by step, and can see the men who, on the mountain-tops of progress, are illuminated by the dawn of the coming day. In my humble opinion the future of dental education lies in the direction of the university. The time must come when the segregated schools must be abandoned, or linked with medical schools or universities, because in those institutions may be found the greatest facilities for study. Great universities possess laboratories and museums and apparatus which smaller institutions cannot afford. Segregated dental schools, for instance, cannot teach anatomy, or physiology, or chemistry as thoroughly as can schools more entirely devoted to such studies, and therefore, to my apprehension, does the future of dental teaching lie in a union with them, that the same professor who has devoted his life to that department, may teach the student in medicine and art and dentistry the same thorough anatomy or chemistry, leaving to special professors the teaching and properly equipping of the ophthalmologist, or dermatologist, or dentist, in his special study. The only possible source of regret may be that, in the accomplishment of this tendency, the old teachers who have grown gray in gaining experience do not cast in their lot with the universities, and continue what they have always been, the leaders and directors in the cause of professional education.

In saying these things I do no injustice to our excellent dental schools. It is to them we owe the very fact that we are a profession to-day. That American dentistry occupies its present high position is due to the old dental colleges, and to the self-sacrificing men who have labored in and with them. But the time is coming, and even now is, when something more is demanded,—when that which has sufficed for the past, that which was even far in advance of the demands of its day, is insufficient for the wants of the advanced profession. Those men who established the dental colleges builded far better than they knew. They laid foundations so broad and so deep that the superstructure which they reared does not cover them. A few years since dentistry did not demand educated men. The dentist was considered simply an artisan, and it was as absurd to demand a preliminary education in him as of a shoemaker. But to-day far weightier responsibilities rest upon him. To him are intrusted important interests and operations unheard-of a generation since. He is supposed to be a gentleman, and to be the companion of gentlemen. He must be versed in matters which imperatively demand a trained mind and educated brain to comprehend, and therefore the great prerequisite to the becoming a competent dentist is a good, liberal education,—a *preliminary examination* before entering upon dental practice. This fact is fully recognized by our English brethren, and to-day they acknowledge no institution that does not require such preparation.

It is a long step in advance when dentistry is acknowledged by the universities, and is given a place within their walls by the side of medicine, law, and theology. It is a recognition of its importance, and of the fact that the world makes the same demands upon its practitioners for intelligence and familiarity with the broad field of general science that it does upon lawyers and preachers. We who are of such recent origin are put in familiar companionship and on terms of perfect equality with those great professions which have existed since men were subjected to illness of the body, oppression by the stronger, and a haunting dread of some possible hereafter. Law, Medicine, and Theology have carefully kept their doors guarded, and jealously resisted encroachments by other guilds from the earliest ages to the present time, scarce admitting Art to a fellowship, and now, wonderful to relate, they meet us on equal grounds. Can any one say this is no advance? It only remains for us to rise to the exigencies of the occasion, and prove by our acts that we are worthy a place among the learned professions. To do this we must demand

of dental students yet higher attainments. We must furnish to them opportunities for full scholastic training. They must enter the lower doors of a universal institution that shall have the facilities for advancing them through all the several grades, until it finally graduates them educated men, and competent, thoroughly equipped dentists.

Dr. WETHERBEE: All the remarks that have been made to-day ignore entirely the very thorough teachings in dental colleges of anatomy and physiology. The whole drift of the argument has been an entire ignoring of this fact, also an entire ignoring of the most thorough and practical teaching of the principles and practice of surgery, as though these were not taught practically, and could only be taught in medical colleges; also the ignoring of therapeutics and pathology. It appears to me that these medical branches can be as thoroughly and efficiently taught in a dental college as in any medical college.

If therapeutics receives proper attention, does it not cover sufficient of medicine to prescribe for certain conditions of the system which are made known to us by certain indications?

I wish to claim for these colleges the credit due them, and I wish, furthermore, to claim this fact,—that every intelligent medical man throughout the length and breadth of the country will acknowledge, —that the practice of medicine is empirical. Our highest, best-educated men in medicine declare this to be so; and if we turn back the wheel of time and note carefully the practice of medicine, and the ten thousand and one times positions have been changed,—to-day a principle accepted, to-morrow doubted,—it will give us a full assurance that the practice of medicine is empirical. And now there is a claim made that we must come up and adopt this empirical child.

Don't understand that I am for a moment contending or pleading for a partial education. My sentiments are too well known by this Association for you to accept for a moment that belief, but we have evils to contend with.

It is necessary to dwell upon them until our dental societies shall cease to take back tracks, until they shall come up to the position requiring every man to have a diploma in order to obtain membership in our societies.

Massachusetts, a few years ago, in her society, established the rule that no man could become a member unless he had a degree, and for some purpose (not unbeknown to me) they abandoned that position and let in everybody that wished to come in.

By this retrograde action we struck a blow against the progress

of dentistry, and until dentists shall come up, as a general thing, and put their foot upon this reception of students in private practice, societies, and colleges,—unless they have a good preliminary education,—we shall be hindered in our work.

But give the dental colleges credit for what they have done. The Boston College, which I represent, no longer receives students except for two years, and they must pass an examination before they can matriculate, requisite to admission to a thorough high school. Does that simply mean a school of lower grade? No: the best high schools. We intend to follow this rule of action and shall maintain it. We have placed ourselves in the line of progress for the purpose of making better men and better dentists.

SECTION I.

Artificial Dentistry, Metallurgy, and Chemistry.

Report by C. S. STOCKTON, Chairman.

SECTION I. has no report on chemistry or metallurgy, but is pleased to record a growing interest in the department of artificial dentistry that is encouraging.

Dr. Kingsley, in his recent work on oral surgery, has called attention to the necessity of this department of our art assuming a higher position than is accorded it in our profession.

Articles have also been commenced in the *Dental Cosmos* upon this subject which promise much in awakening an increased interest in this department. While the older methods of work have undergone no great change during the past year, we report improvement in the working of celluloid that renders this base more certain in its results. The improvement is the perfection of the new mode of celluloid machines invented by Dr. Campbell, by which the celluloid undergoes a process of curing while the plate is being pressed, the material thereby being made much harder and much less liable to discolor or warp while being worn.

In the manufacture of teeth there is a decided improvement in the forms of the bicuspids and molars, some of the manufacturers having the courage to attempt the introduction of the *natural* forms of these teeth, though the best of these attempts leave much to be desired. The first superior bicuspids are still smaller than the second; such arrangement is contrary to nature. The cuspids are also manufactured of the same shade as the rest of the denture, instead of being yellower, as nature makes them.

As many are advanced in years who require our services in this department, we would suggest the manufacture of teeth that will represent the effect of *wear* upon the cutting and grinding surfaces, and exhibit the effect of use often noticed upon these surfaces.

There are at present no such teeth to be obtained in the dental depôts, so that in partial cases we have only recourse to means that will glaringly exhibit the artificiality of our work upon the slightest exposure. A change in these respects is earnestly recommended.

We would also call your attention to the new metallic base, "Reese's Gold Alloy." This is a cast base, and promises much in the way of accuracy of fit and a better health of the mouth.

With every encouragement to continued advancement in this department of Section I., this brief report is respectfully submitted.

SECTION I.—Continued.

ESSAY, BY EBEN M. FLAGG, OF THE SECTION.

Dental Art.

THERE is an element which enters into the conception and execution of every branch of our labor, and more or less forms part of every operation that we are called upon to make, be it surgical, operative, or prosthetic. This element lightens our drudgery, enlarges our souls, gives individuality to our work, and brings a satisfaction to ourselves that fully repays the time spent in fulfilling its requirements. It was born with our race, and has inseparably accompanied every movement that has brought happiness or comfort to man. It has contributed its share toward raising the physician from a mere "bleeding, physicking, leeching" animal to the position he occupies to-day, and has shown the mechanic and inventor that if he would be great, he must be more than an *artisan*. He must be an artist. This element, the element of art, wherever it enters the field of human life, has for its function to finish and render attractive the hard labor that preceded it. Thus we do not find it in its full manifestation, except in those departments of labor which have attained scientific certainty.

Nearly all professions have had for their origin the desire to relieve some present distress, moral or physical, and it is only after this desire has been accomplished that the element of art can enter and embellish that which was born of distress. *Our* profession is no exception to the general rule. We see in the operation of gold filling that men of genius are dissatisfied with the mere work of

stuffing a cavity full of soft foil that an excavator can penetrate to the base, and they do not consider the operation complete until the mutilated organ has received that form which nature gave it, and the eye is not offended by straight lines and vacant spaces which were never designed to exist. Yet there was a time when this soft-foil stuffing was supposed to subserve every purpose that could be required of gold filling, and it seems there are men to-day who apparently pray to be delivered from the impious wish of ever knowing more than their ancestors did upon this subject, and who eagerly bring to light and comment upon every blunder made in the effort of "restoration." I would call the attention of such to the words of one of the greatest art critics, John Ruskin, "I like to see a blunder, for *that* shows me that there *has* been an effort."

We find that the necessity for art in dentistry exists in proportion to the hopelessness of the case. The greater the amount of lost tissue to be replaced, the greater the knowledge of *natural* form required to properly effect its replacement. Beginning with the restoration of portions of teeth through gold fillings, we come to the loss of the entire crown, and, finally, to that last resort, the replacement of the entire denture. Knowledge of form and color, of expression, character, and effect, now becomes imperative to the dentist. To relieve the condition of his patient, the arts of the sculptor and colorist must be studied with more care than many of us are wont to give them, while a knowledge of temperament and physiognomy becomes an important element in our work. The patient, through the loss of his teeth, has not only suffered himself, but a wrong has been perpetrated on his fellow-beings through broken natural law, and he must not be permitted to give pain to others through the exhibition of a hideous deformity; for it is not *vanity*, but a duty we owe our fellow-beings that we look as well as possible; and we, as dentists, who have been obliged to study *physiology* that we might understand *pathology*, must now study beauty to avoid ugliness, and nature, that we may avoid what is unnatural.

The only way in which we *can* study nature with satisfaction is to court her with such earnestness that she will bestow upon us her favors and make known unto us her hidden parts. We should copy and reproduce her healthful forms as do men in any other department of art, and keep them carefully in our laboratories for reference and study. If an irregular denture is to be made straight, there is often no greater help to that end than a model taken from a plaster impression of a regular denture of corresponding age and size. A study

of this model will often in one moment give a better idea of the changes required in the mal-positioned denture than hours of unaided exercise of the imagination.

If a complete denture is to be made, another model, taken from a plaster impression of a complete set of natural teeth in the mouth of a patient of corresponding age and temperament, will lighten our task and prove to us an invaluable guide. These models are not very difficult to obtain. Often a lady patient will feel complimented at being asked to give a sitting for an impression of her perfect mouth, if it be asked in the right manner and she knows it is to be used in the interests of science, and to assist in relieving her more unfortunate fellow-beings.

It has been my plan, after taking impressions for study, to label each model with a description of the person it represents. The temperament, age, sex, and color of hair and eyes are noted, and two porcelain teeth selected to accompany the case, one to correspond with the color of the canine tooth and the other the remainder of the teeth on the model. It is sometimes a good plan to paint the incisors and canines of the plaster model, so that their relative colors may be seen, and I have found these models useful not only in regulating teeth and constructing artificial dentures, but also in shaping contour fillings where the rubber dam conceals corresponding teeth, and where we cannot turn the patient's head in such a manner as to get the shape of the tooth from different points of view, so readily as we can a plaster model. If students will commence the study of their art by carefully collecting models from plaster impressions, the education obtained from studying them would never permit the acceptance of the China-ware for which (and I say it with regret) a demand has been established at the dental depôts. I have been struck with awe at the shapes of some of the bicuspids and molars exposed for sale, and believe that, without infringement of the decalogue, one might well fall down and worship them, for verily to my knowledge there is nothing like them "in the heaven above, nor in the earth beneath, nor in the waters under the earth;" and they must serve to educate the young mind backward rather than forward.

With the study of our art from natural models, we could never allow ourselves to make the first superior bicuspidati smaller than the second, and the cuspidati of the same shade as the rest of the denture; we would not make the standard of excellence in a dental substitute a question of how evenly the cusps of the teeth would sit

upon a flat board; nor would we permit ourselves to use moulded gum-sections which make our patients' mouths look pretty much alike, varying only a little more or less in different degrees of ghastliness.

I sometimes think that our art could receive no better impetus than would be followed by the sudden destruction of every gum-section in the country; for then the profession would be compelled to furnish their own ideas on expression to their patients, while now, in consequence of inactivity in that direction, there has been great danger that if the present system of gum-sections continued they would have no ideas to furnish. It may be well to add, while we are on this subject, that I have already known, in New York City, of dentists leading their patients to the depôts and there allowing the patients to select from the trays the set of teeth that they most fancied, just as they would select a bonnet or a pair of boots.

Much has been said about the effect of rubber to bring dental art to its present degraded position. A paper like this is not the place in which to discuss various materials. That belongs more to the mechanical than the artistic department of our work, and art is too broad a subject to be ridden by hobbies or pet theories; still, it is only due in justice to say that through the process by which rubber is worked, it must produce a detrimental effect upon the advancement of anything artistic. The model is destroyed by the process of boiling that it undergoes in the vulcanizer, and all opportunity of future study of the case is thereby lost, and the lack of this opportunity for study very soon begets a lesser desire for study, so that men who are students are prone to turn away from a subject where ideality is likely to receive so little remuneration. But this subject is so vast, that in a paper like the present one must be content to merely call attention to the necessity of reconsidering a department that has long lain neglected, and whose neglect has degraded the profession as artists in the eyes of an intelligent public, without doing away with *their* necessity for a department of art whose requirements are but miserably fulfilled.

L.H.B.

TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION

AT THE

TWENTY-FIRST ANNUAL SESSION,

HELD AT NEW YORK,

COMMENCING ON THE 11TH OF JULY, 1881.

PUBLICATION COMMITTEE:

GEO. H. CUSHING, M. S. DEAN, E. T. DARBY.

PHILADELPHIA:
THE S. S. WHITE DENTAL MANUFACTURING CO.
1882.

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FIRST DIVISION—COMMITTEE OF ARRANGEMENTS.

*COOK, ODELL, AND MOORE.

SECOND DIVISION—ON CREDENTIALS, ETHICS, AND AUDITING ACCOUNTS.

*CROUSE, *STOCKTON, AND PERRY.

THIRD DIVISION—ON VOLUNTEER ESSAYS.

PEIRCE, MORGAN, AND REHWINKEL.

* These go out August, 1882.

CONTENTS.

	PAGE
Disclaimer	2
Officers from date of organization	3–6
Roll-call	11–14
Amendments to Constitution adopted	14
Hours of meeting and adjournment fixed	14
Resolution approving the action of the officers in calling the meeting in advance of its regular time	14
Publication Committee's report	15
Motion to devote afternoon to work in Sections	15
Credential Committee's report	15
Vacancies in Executive Committee filled	16
Request of Dr. Atkinson that Stephen Pearl Andrews read the report on Nomenclature and Terminology	16
Motion to defer discussion of Nomenclature and Terminology	17
Report of Section IV.	17
Selection of place of next meeting and election of officers made special order for Thursday evening	17
President's address referred	18
Directory Committee's report and action thereon	18
Report of Section V.	18
Treasurer's report audited	19
Treasurer instructed to pay properly authenticated orders	19
Report of Committee on Volunteer Papers on Dr. Buchanan's paper	19
Order of discussion of subjects presented by Section V. fixed	19
Photographer's proposition accepted	19
Committee appointed to draft resolutions regarding the attempted assassination of the President	20
Adoption of Auditing Committee's report	20
Motion of Dr. Atkinson to devote time to Prof. Buchanan	20
Report of Section VI.	21
Resolution of Dr. Mills to secure appointment of dentists in the army	21
Resolutions of Dr. Waters on proposed action of Congress in reference to visual acuteness and color-blindness	21
Proposition to make Dr. E. Pierrepont, of London, England, an honorary member, and action thereon	21

PAGE
Report of Committee on Attempted Assassination of the President . . 22
Election of officers and selection of place of next meeting 22
Constitution and Code of Ethics ordered printed 22
Organization of Sections 23
Time of adjournment extended 24
Motion of Dr. Crouse as to violators of Code of Ethics 24
Installation of the new officers 25
Publication Committee instructed 25
Thanks extended to Local Committee, to retiring officers, to press reporters, to Dr. Buchanan, and to the proprietors of the Westminster Hotel . . 25
Publication Committee appointed 25
Local Committee of Arrangements appointed 25
Amendment to the Constitution proposed 25
Constitution 26
Standing Resolutions 36
Code of Ethics 38

REPORTS AND VOLUNTEER PAPERS.

President's address 41

Section III.

Report on Nomenclature and Terminology, by W. H. Atkinson, Chairman, 46

Section IV.

Paper on Operative Dentistry, by George J. Friedrichs 58

Section V.

Paper on Reflex Action and Shock, by E. S. Niles 88
Paper on Histology, by C. F. W. Bödecker 94
Paper on Chemical Abrasion, by Isaac B. Davenport 98

Section VI.

No report 145

Section I.

Paper on Artificial Dentistry, by John Allen 146
Paper on Dental Prosthesis, by Geo. F. Grant 148
Paper on Artistic Dentistry *vs.* Mechanical, by D. G. Harrington . . 156
Paper on Artificial Dentistry—its present status, etc., by Eben M. Flagg . 160

Section II.

Volunteer paper on Education, by Wm. H. Atkinson 164
Paper on Education, by T. W. Brophy 169

VOLUNTEER PAPER.

Essay on the Centric Relation of the Teeth, etc., to the entire Constitution, by Joseph Rodes Buchanan 193

DISCUSSIONS.

PAGE

Nomenclature and Terminology—discussed by
- Dr. Atkinson 55
- Dr. Waters 56

Operative Dentistry—discussed by
- Dr. Atkinson 63, 65, 71, 74
- Dr. Wetherbee 63, 74, 84
- Dr. McKellops 65, 68
- Dr. Barrett 66
- Dr. Brophy 67, 68
- Dr. Waters 68
- Dr. Mills 70, 81
- Dr. Litch 70, 71
- Dr. Niles 73, 74
- Dr. Meriam 74
- Dr. Webb 74, 75
- Dr. Shumway 75, 77, 78, 86
- Dr. Crouse 77, 78, 79, 80, 81, 83
- Dr. Beck 78, 79
- Dr. Barker 79
- Dr. LaRoche 79
- Dr. Andrews 80
- Dr. Palmer 86

Reflex Action—discussed by
- Dr. Bödecker 101
- Dr. Atkinson 101
- Dr. Barrett 103
- Dr. Buckingham 104

Dental Caries—discussed by
- Dr. Abbott 105, 108, 111, 112, 113, 114, 116, 117, 118, 120, 124
- Dr. Chandler 108, 114
- Dr. Niles 108, 110, 111, 112, 113
- Dr. Buckingham 109, 115
- Dr. Bödecker 109
- Dr. Mills 115, 116
- Dr. Crouse 116, 117, 124, 125
- Dr. Atkinson 118, 125
- Dr. Waters 119
- Dr. Brophy 119, 120, 121
- Dr. Friedrichs 120
- Dr. Moore 121
- Dr. Peirce 121
- Dr. Taft 123, 125

Abrasion—discussed by
- Dr. Chandler 125
- Dr. Atkinson 126
- Dr. Barrett 127, 129

PAGE

Abrasion (continued)—discussed by
Dr. Litch 128
Dr. Cushing 128
Dr. Fundenberg 128, 129
Dr. Brockway 129
Dr. Waters 129

Anesthesia—discussed by
Dr. Barrett 130, 137, 138, 141
Dr. Buckingham 137, 143
Dr. Meigs 137, 138
Dr. Litch 138, 142
Dr. Atkinson 142
Dr. Buckingham 143

Education—discussed by
Dr. Litch 176, 181, 182, 188
Dr. Shepard 179, 185, 186, 187
Dr. Odell 181
Dr. Stockton 181
Dr. Brophy 182, 185
Dr. Wetherbee 182
Dr. Hunter 185
Dr. Butler 187, 188
Dr. Buckingham 187, 190
Dr. Atkinson 189
Dr. Abbott 189

MINUTES OF TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION.

SESSION OF 1881.

BY GEO. H. CUSHING, SECRETARY.

FIRST DAY—MORNING SESSION.

THE AMERICAN DENTAL ASSOCIATION commenced its Twenty-first Annual Session at Irving Hall, New York City, Tuesday, July 12, 1881, at 11 o'clock, A.M., the President, C. N. Peirce, in the Chair.

The session was opened with prayer by Dr. I. J. Wetherbee.

The roll of qualified members was then called, and the following were found either to be present or to have forwarded their dues:

ATKINSON, WM. H.	41 East Ninth st., New York.
ABBOTT, FRANK	22 West Fortieth st., New York.
ALLEN, JOHN	314 Fifth ave., New York.
ANDREWS, ROBERT R.	Cambridge, Mass.
ADAMS, J. F.	Worcester, Mass.
ALLEN, WM. H.	18 West Eleventh st., New York.
* BROWN, SENECA B.	Fort Wayne, Ind.
* BAUER, JOSEPH	130 Esplanade st., New Orleans.
BUCKINGHAM, T. L.	1228 Arch st., Philadelphia.
BARRETT, W. C.	11 West Chippewa st., Buffalo, N. Y.
* BRACKETT, C. A.	64 Touro st., Newport, R. I.
BROPHY, T. W.	125 State st., Chicago.
BARKER, WM.	283 Westminster st., Providence, R. I.
BRYAN, LYMAN C.	1202 Washington st., Boston.
BRONSON, W. A.	8 East Thirty-fourth st., New York.
* BOGUE, E. A.	29 East Twentieth st., New York.
BÖDECKER, C. F. W.	54 East Fifty-eighth st., New York.
* BUCKLAND, A. W.	Woonsocket, R. I.
BECK, C. S.	Wilkesbarre, Pennsylvania.

Those marked thus (*) were absent but sent their dues.

BUTLER, CHARLES R.	Cleveland, Ohio.
BISHOP, J. ADAMS	32 West Thirty-sixth st., New York.
BROWN, G. CARLETON	116 Broad st., Elizabeth, New Jersey.
BROCKWAY, A. H.	13 Greene ave., Brooklyn, N. Y.
CROUSE, J. N.	2101 Michigan ave., Chicago.
CHANDLER, THOS. H.	74 Commonwealth ave., Boston.
* CLELAND, JAS.	Detroit, Michigan.
* COWIE, HENRY	Detroit, Michigan.
COBURN, H. W.	Lowell, Mass.
CHAIM, M. L.	30 Cooper Institute, New York.
CUSHING, GEO. H.	34 Monroe st., Chicago.
COOLIDGE, J. B.	2304 Tremont st., Boston.
CLAPP, D. M.	196 Boylston st., Boston.
COLTON, A.	Hudson, N. Y.
COOK, C. D.	133 Pacific st., Brooklyn, N. Y.
* COLGROVE, W. H.	Johnstown, N. Y.
CANINE, J. F.	Louisville, Ky.
* DAVIS, E. B.	Concord, N. H.
* DAVIS, K. B.	Springfield, Ill.
DARBY, E. T.	1513 Walnut st., Philadelphia.
DUDLEY, A. M.	223 Essex st., Salem, Mass.
DODGE, MILES H.	20 East Thirty-third st., New York.
* DEAN, M. S.	34 Monroe st., Chicago.
DICKERMAN, D. S.	Taunton, Mass.
DAVENPORT, I. B.	Williamstown, Mass.
DAVENPORT, S. E.	Northampton, Mass.
EMMINGER, A. F.	Columbus, Ohio.
FRIEDRICHS, GEO. J.	155 St. Charles st., New Orleans.
FARRAR, J. N.	15 Greene ave., Brooklyn, N. Y.
FIELD, GEO. L.	Detroit, Michigan.
FUNDENBURG, W. H.	323 Penn ave., Pittsburg, Penn.
* FILLEBROWN, THOS.	Portland, Maine.
FILBERT, P. K.	Pottsville, Penn.
* FINLEY, M. F.	Ypsilanti, Michigan.
* FREEMAN, A. W.	1354 Wabash ave., Chicago.
FLAGG, EBEN M.	22 West Eleventh st., New York.
GODDARD, WM. H.	Louisville, Ky.
GRANT, GEO. F.	86 Pinckney st., Boston.
GUILFORD, S. H.	4006 Chestnut st., Philadelphia.
GERRY, G. A.	Lowell, Mass.
GAYLORD, E. S.	New Haven, Conn.
* HARRINGTON, D. G.	Boston, Mass.
HOYSRADT, G. W.	Ithaca, N. Y.
* HILL, J. L.	Gettysburg, Penn.
HUNTER, E.	Jackson, Mich.
* HOLMES, E. S.	Grand Rapids, Mich.
* INGERSOLL, L. C.	Keokuk, Iowa.

JARVIE, WM., JR.	Brooklyn, N. Y.
JONES, W. H.	Northampton, Mass.
KLUMP, G. W.	Williamsport, Penn.
* KEELY, GEO. W.	Oxford, Ohio.
* KITCHEN, C. A.	Rockford, Ill.
* KINGSBURY, C. A.	Philadelphia.
LATHROP, JOSEPH	Detroit, Mich.
LITCH, WILBUR F.	1627 Chestnut st., Philadelphia.
LORD, BENJAMIN	New York.
LEECH, H. K.	3610 Market st., Philadelphia.
LA ROCHE, W. T.	67 West Fifty-fourth st., New York.
MCKELLOPS, H. J.	2630 Washington ave., St. Louis.
MILLS, GEO. A.	169½ Columbia Heights, Brooklyn, N.Y.
MERIAM, H. C.	257 Essex st., Salem, Mass.
MEIGS, GEO. S.	113 West Thirty-fourth st., New York.
MOORE, THOS. T.	Columbia, S. C.
MCMANUS, JAS.	Hartford, Conn.
MERRITT, CHARLES	25 West Twenty-third st., New York.
* MORRISON, W. N.	1337 Washington ave., St. Louis.
MCNAUGHTON, D. C.	Jersey City, N. J.
MCDOUGALL, S. J.	375 Columbus ave., Boston.
MORGAN, N.	394 Main st., Springfield, Mass.
MELONEY, C. W.	29 East Twentieth st., New York.
NILES, E. S.	146 Boylston st., Boston.
NEALL, E. H.	1314 Arch st., Philadelphia.
* NOBLE, H. B.	1111 Pennsylvania ave., Washington.
OSGOOD, C. H.	147 Tremont st., Boston.
ODELL, FRANK M.	18 West Eleventh st., New York.
PEIRCE, C. N.	1415 Walnut st., Philadelphia.
PAGE, W. E.	Charlestown District, Boston.
PRIEST, A. N.	Utica, N. Y.
PARTRIDGE, CHARLES W.	Lawrence, Mass.
PETTEE, A. L.	Brattleboro, Vermont.
PALMER, S. B.	39½ Warren st., Syracuse, N. Y.
PALMER, JAMES G.	New Brunswick, N. J.
PARKER, C. B.	152 Clinton st., Brooklyn, N. Y.
REHWINKEL, F. H.	Chillicothe, Ohio.
RIDEOUT, LEON	Lynn, Mass.
RHEIN, MEYER L.	7 West Thirty-eighth st., New York.
SHEPARD, L. D.	100 Boylston st., Boston.
SMITH, J. H.	New Haven, Conn.
SHUMWAY, T. D.	Plymouth, Mass.
* STEVENS, S. G.	Lynn, Mass.
STARBUCK, W. C.	Jamaica Plain, Mass.
* STELLWAGEN, T. C.	1627 Chestnut st., Philadelphia.
STOCKTON, C. S.	Newark, N. J.
SMITH, H. A.	286 Race st., Cincinnati.

SMITH, D. D.	1417 Walnut st., Philadelphia.
SEARLE, FLAVIUS	Springfield, Mass.
* SWASEY, J. A.	3003 Michigan ave., Chicago.
* SEABURY, F. N.	Providence, R. I.
TAFT, J.	117 West Fourth st., Cincinnati, Ohio.
TILLINGHAST, W. H.	220 Westminster st., Providence, R. I.
TALBOT, E. S.	125 State st., Chicago.
TOLEDO, M. V.	113 East Eighteenth st., New York.
WETHERBEE, I. J.	46 Dover st., Boston.
WATKINS, S. C. G.	Montclair, N. J.
WATERS, GEO. F.	8 Beacon st., Boston.
WEBB, M. H.	Lancaster, Penn.
WATLING, J. A.	Ypsilanti, Mich.
WOODWARD, C. A.	318 Madison ave., New York.
* WERNER, J. G. W.	41 Upton st., Boston.
* WHINERY, J. C.	Salem, Ohio.

On motion, the reading of the printed minutes of last year's meeting was dispensed with.

The President then read his address.

The following amendment to the Constitution offered last year by Dr. Priest was then adopted:

To add to Section 5 of Article III. of the Constitution, under the head of "Permanent Members," "After the resignation of a member has been accepted, the Association may, at any time thereafter, reinstate such member by unanimous consent."

The following amendment to the Constitution offered last year by Dr. Dean was also adopted:

To amend Section 1 of Article VI. of the Constitution so that the first sentence shall read "To prepare, arrange, and expedite business, this Association shall be divided into seven Sections, as follows:" And to change Section V. so as to read "Anatomy, Histology, and Microscopy," and to add "Section VII., Physiology and Etiology."

On motion of Dr. Shepard the following hours of meeting and adjournment were adopted: 9 to 12.30 A. M., 2 to 5 P. M., and 8 P. M. to adjournment.

The following resolution offered by Dr. Shepard was then adopted:

Resolved, That the action of the officers of this Association in calling this meeting in advance of the regular time designated by the Constitution is hereby approved and made the act of the Association.

The Publication Committee offered the following report, which was accepted and its suggestions adopted:

The Publication Committee would respectfully submit the following report:

In accordance with the instructions of the Association they opened correspondence with different publishers regarding the printing of the Transactions; finally accepting the proposition of the Trustees of S. S. White.

Three hundred copies of Transactions were furnished the Association, of which about two hundred and thirty-five copies have been duly distributed as per the Treasurer's list, and to the various libraries, universities, journals, and honorary members.

Of the character of the work done by the Trustees of S. S. White, the volume speaks for itself; but the Association can not know how much it owes to these gentlemen, and particularly to Mr. Hise, who had charge of the publishing department.

Without the very intelligent and diligent services they rendered, you could not have had so fine an edition of Transactions, while your editor and publishers were so widely separated.

The committee feel that the warm thanks of the Association are due to the gentlemen above named for the valuable services they have rendered.

The following is a statement of the financial condition:

Received of Treasurer	$30 00
From sale of Transactions	8 75
	$38 75
Expended for postage, envelopes, paper, expressage, and incidental expenses	$44 15
Due the Committee	$10 40

Respectfully,

GEO. H. CUSHING, *Chairman.*

We have examined the above report and find it correct.

C. S. STOCKTON, J. N. CROUSE, } *Ex. Com.*

On motion of Dr. Crouse it was voted to devote this afternoon to work in the Sections, and that when we adjourn, we do so to meet at 8 o'clock P. M.

Announcements of the time and place of meeting of the different Sections were then made.

The Committee on Credentials then made a partial report, which was subsequently completed as follows:

Alumni Association of Boston Dental College—Lyman C. Bryan, W. C. Starbuck.

American Academy of Dental Science—H. C. Meriam.
Boston Dental College—I. J. Wetherbee.
Brooklyn Dental Society—C. B. Parker.
Central Dental Association of Northern New Jersey—G. Carleton Brown, J. G Palmer.
Chicago Dental Society—T. W. Brophy, E. S. Talbot.
Connecticut Valley Dental Association—J. F. Adams, A. L. Pettee, N. Morgan, S. E. Davenport, W. H. Jones.
First District Dental Society of the State of New York—M. H. Dodge, J. A Bishop, C. Merritt, G. S. Meigs, W. T. La Roche, M. L. Rhein, M. V. Toledo, C. A. Woodward.
Harvard Odontological Society—E. S. Niles, W. E. Page.
Illinois State Dental Society—Geo. H. Cushing, J. N. Crouse.
Kentucky State Dental Society—Wm. H. Goddard, J. F. Canine.
Massachusetts Dental Society—D. M. Clapp, F. Searle.
Merrimack Valley Dental Society—J. B. Coolidge, G. F. Grant, G. A. Gerry, C. W. Partridge, W. H. Tillinghast.
Michigan Dental Association—E. Hunter.
New Jersey State Dental Society—C. S. Stockton, C. W. Meloney, S. C. G. Watkins.
New Orleans Odontological Society—Geo. J. Friedrichs.
New York Odontological Society—Wm. Jarvie, Jr., Benjamin Lord.
Odontological Society of Pennsylvania—H. K. Leech.
Pennsylvania Association of Dental Surgeons—E. H. Neall, W. F. Litch.

On motion, adjourned till 8 P. M.

FIRST DAY—EVENING SESSION.

The Association was called to order by President Peirce at 8.20 P. M.

The minutes of the morning session were read and approved.

The Executive Committee reported that they had filled vacancies in their committee as follows:

Section 1. L. D. Shepard. Section 3. F. H. Rehwinkel and H. A. Smith.

The consideration of the reports of Sections being in order, Section III. was called. The chairman, Dr. Atkinson, said "The report we have prepared is a continuation of the former reports, and I would ask the privilege of having Professor Stephen Pearl Andrews read it, as it is in his handwriting and principally his work."

The request was complied with, and Professor Andrews read the report.

On motion of Dr. Abbott the discussion of the report was postponed until the arrival of Dr. Taft.

Section IV. being called, Dr. Webb made a brief report, as follows:

Section IV. recommends the reading of a paper on Operative Dentistry, by Dr. Friedrichs, and the following subjects for discussion:—Root Filling; Alveolar Abscess,—how best treated; Arterial Nævus,—how treated; Styptics in Dental Practice; The Mallet, a Dangerous Instrument in the Process of Filling Teeth; and Artificial Crowns.

The first subject under the report being "Root Filling," was then taken up and discussed by Drs. Atkinson and Wetherbee,—

When the rules were suspended, and it was voted to make the special order for Thursday evening, the selection of the place of the next meeting and the election of officers.

The regular order being resumed, the discussion on "Root Filling" was continued by Drs. Atkinson, McKellops, Barrett, Brophy, and Waters.

On motion, adjourned till 9 o'clock, A.M., to-morrow.

SECOND DAY—MORNING SESSION.

The Association met at 9.30 A.M., President Peirce in the Chair.

The minutes of the last evening session were read and approved.

There being no miscellaneous business, the regular order of consideration of reports of Sections was resumed, and a paper was read on Cylinder Fillings, by Dr. Friedrichs; at the conclusion of which the President called Section III. in accordance with the motion passed last evening "to postpone discussion of the subjects of this Section until the arrival of Dr. Taft."

Dr. Taft having no report, the subject of "Nomenclature and Terminology" was discussed by Drs. Atkinson and Waters and Mr. Stephen Pearl Andrews.

The subject of Operative Dentistry being resumed, was discussed by Drs. Mills, Litch, Niles, Meriam, Webb, Shumway, Beck, Barker, of Providence, La Roche, Andrews, Crouse, and S. B. Palmer, of Syracuse.

The Committee on Credentials made a supplemental report.

Adjourned till 2 P.M.

SECOND DAY—AFTERNOON SESSION.

The Association met at 2.30 P.M., the President, Dr. Peirce, in the Chair.

The minutes of the morning session were read and approved.

Miscellaneous business being in order, on motion of Dr. Crouse, the President's address was referred to the Sections on Education and Etiology.

Dr. McNaughton, Chairman of the Committee on Directory, made a report, which was accepted. It was moved that the report be adopted.

On motion, the whole subject was laid upon the table.

On motion, the subject of Operative Dentistry was passed.

Section V. being called, the report stating the papers to be submitted was read.

A paper on "Reflex Action and Shock in the Dental Specialty," by Dr. Niles, of Boston, was then read, also one by Dr. Bödecker, on Dental Histology. A verbal report on Dental Caries was made by Dr. Abbott, and a paper was read by Dr. Davenport, of Williamstown, Mass., on "Chemical Abrasion of the Front Teeth."

Adjourned to 8 P.M.

SECOND DAY—EVENING SESSION.

The Association met at 8.30 P.M., the President, Dr. Peirce, in the Chair.

The minutes of the afternoon session were read and approved.

The Executive Committee reported that they had examined the Treasurer's account and found it correct.

The following resolution was adopted:

Resolved, That the Treasurer is hereby instructed to pay all properly authenticated orders drawn against him by the officers of this Association.

The regular order being resumed, the consideration of subjects in Section V. was continued.

Dr. Barrett made some remarks on Anesthesia, with questions by Drs. Buckingham and Meigs, of New York.

The Committee on Volunteer Papers made a report, recommending that the paper by Prof. Buchanan be *not* read, unless there should be time at the close of the sessions.

The report was accepted and adopted.

On motion, it was decided to discuss the subjects presented by Section V. in the order in which they had been presented.

Dr. Niles's paper was discussed by Drs. Bödecker, Atkinson, Barrett, and Buckingham.

Dr. Abbott's address was discussed by Dr. Buckingham.

On motion, adjourned till to-morrow morning at 9 o'clock.

THIRD DAY—MORNING SESSION.

The Association was called to order at 9.30 A.M., the President, Dr. Peirce, in the Chair.

The minutes of the evening session were read and approved.

The Committee on Credentials made a further supplementary report.

On motion, the Association decided to accept the proposition to be photographed at 12.30, after adjournment.

The regular order being resumed, the discussion of Dr. Abbott's address was continued by Drs. Bödecker, Buckingham, Niles, Abbott, Chandler, Mills, Crouse, Atkinson, Waters, Brophy, Moore, Peirce, and Taft.

On motion, the subject was passed.

On motion, adjourned till 2 P.M.

THIRD DAY—AFTERNOON SESSION.

The Association met at 2.30 P.M., the President, Dr. Peirce, in the Chair.

The minutes of the morning session were read and approved.

On motion of Dr. Abbott, the President appointed the following committee to draft resolutions regarding the attempted assassination of the President of the United States: Drs. Frank Abbott, W. F. Litch, and Geo. J. Friedrichs.

The Auditing Committee reported that they had examined the financial report of the Publication Committee and found it correct.

The report was accepted and adopted.

The report of the Auditing Committee made yesterday regarding the Treasurer's report was also accepted and adopted.

Dr. Atkinson moved that half an hour be set apart to-morrow at 9 A.M. to enable Prof. Buchanan to read such part of his paper as he may be able to read in that time. Carried.

The regular order being resumed, Dr. Davenport's paper on Abrasion was discussed by Drs. Chandler, Atkinson, Barrett, Litch, Cushing, Fundenburg, Brockway, and Waters.

On motion, the subject was passed.

Anesthesia was then discussed by Drs. Litch, Barrett, Atkinson, and Buckingham.

On motion, the subject was passed.

Section VI. being called, the chairman, Dr. Odell, stated that there was no report ready.

Section I. was called, and the chairman, Dr. Stockton, made a brief report, which was followed by a paper by Dr. John Allen, one by Dr. Grant, of Boston, and one by Dr. E. M. Flagg, of New York.

The following resolution offered by Dr. Mills and seconded by Dr. Atkinson was then adopted:

Resolved, That in consideration of the fact that the officers of the United States Army are about making an effort by concerted action to secure the appointment of competent dentists to the different army posts, we therefore pledge ourselves to give all the aid and co-operation in our power to bring about so desirable a result.

On motion, adjourned to meet at 8 P.M. this evening.

THIRD DAY—EVENING SESSION.

The Association was called to order at 8 P.M., the President, Dr. Peirce, in the Chair.

The minutes of the afternoon session were read and approved.

The following offered by Dr. Waters was passed:

WHEREAS, A petition has been presented to Congress asking for the calling of an international congress to consider and agree upon standard methods of testing visual acuteness and color-blindness, and standard requirements of these necessary qualifications in the navies and merchant marine,

Resolved, That the American Dental Association heartily approves of the proposed international commission, and hereby directs the Secretary of the Association to transmit this expression of our views to Congress when next assembled.

The Committee on Credentials made a supplemental report.

Dr. Geo. L. Field, of Detroit, proposed that Dr. E. Pierrepont, of London, England, be made an honorary member.

Dr. Taft moved that the matter be referred to a committee of three, to report to the Association to-morrow morning. Carried, and the chair appointed as that committee Drs. Taft, Shepard, and Rehwinkel.

The committee appointed to draft resolutions regarding the attempt to assassinate President Garfield made the following report, which was unanimously adopted by a rising vote:

Resolved, That we sympathize profoundly with President James A. Garfield and his family in their present affliction.

Resolved, That we are utterly lacking in language sufficiently forcible to express our abhorrence of the attempt at his assassination and of its author.

Resolved, That it is our fervent prayer, that in President Garfield we may continue to have a living example of a noble man bravely bearing up under difficulties.

FRANK ABBOTT,
GEO. J. FRIEDRICHS,
WILBUR F. LITCH.

The special order for the evening being now called, the balloting for the place of next meeting was proceeded with, resulting in the choice of Cincinnati.

The election of officers resulted in the choice of

President—H. A. Smith, of Cincinnati.
First Vice-President—W. C. Barrett, of Buffalo.
Second Vice-President—Geo. J. Friedrichs, of New Orleans.
Recording Secretary—Geo. H. Cushing, of Chicago.
Corresponding Secretary—A. M. Dudley, of Salem, Mass.
Treasurer—Wm. H. Goddard, of Louisville.
Executive Committee—C. N. Peirce, F. H. Rehwinkel, F. M. Odell.

On motion of Dr. Goddard, the Publication Committee was instructed to have printed five hundred copies of the Amended Constitution and Code of Ethics.

On motion, adjourned to meet at 9 o'clock to-morrow morning.

FOURTH DAY—MORNING SESSION.

The Association was called to order at 9.15 A.M., the President, Dr. Peirce in the chair.

The minutes of last evening's session were read and approved.

In accordance with the resolution passed yesterday Dr. Buchanan was now given half an hour in which to explain his views.

The regular order being resumed, and the chairman of Section I. being absent, this Section was temporarily passed.

Section II. was then called. There was no report from the Section, but papers were presented by Drs. Atkinson, Fillebrown, and Brophy. In the absence of Dr. Fillebrown his paper was read by Dr. Brown.

The subject was discussed by Drs. Litch, Shepard, Odell, Jno. Allen, and Stockton.

The rules were here suspended to enable the Sections to organize, with the following result:

SECTION I. Artificial Dentistry, Chemistry, and Metallurgy.—C. S. Stockton, Chairman; W. H. Fundenberg, L. L. Buckland, T. L. Buckingham, C. C. Carroll, C. W. Clement, W. P. Church, J. O. Cook, Eben M. Flagg, G. F. Grant, Geo. A. Gerry, D. G. Harrington, J. L. Hill, E. Honsinger, E. S. Holmes, F. A. Hunter, W. Storer How, F. N. Seabury, E. D. Swain, J. A. Swasey, E. S. Talbot, A. W. Tenney, J. A. Watling, C. A. Woodward, J. C. Whinery, Geo. H. Wilson, D. F. Whitten.

SECTION II. Dental Education.—J. N. Crouse, Chairman; T. W. Brophy, Secretary; W. W. Allport, W. H. Morgan, C. N. Peirce, Thos. Fillebrown, C. J. Essig, Jno. M. Hurtt, W. H. Jones, Chas. D. Cook, T. H. Chandler, Henry Cowie, M. L. Chaim, A. Colton, W. H. Colgrove, L. D. Shepard, J. H. Smith, G. Carleton Brown, John Allen, G. W. Klump, L. C. Bryan, K. B. Davis, C. E. Francis, Isaiah Forbes, O. F. Harris, J. S. Hurlbut, C. S. Hurlbut, D. B. Ingalls, H. H. Jackson, C. A. Kingsbury, C. A. Kitchen, Joseph Lathrop, W. N. Morrison, D. C. McNaughton, J. S. McCampbell, A. L. Northrop, C. H. Osgood, A. L. Pettee, S. G. Stevens, C. W. Spalding, S. D. Stewart, J. G. Templeton, C. P. Wilson, Geo. A. Young.

SECTION III. Dental Literature and Nomenclature.—W. H. Atkinson, Chairman; J. Taft, Secretary; M. V. Toledo, W. A. Bronson, D. S. Dickerman, W. C. Dyer, S. W. Dennis, I. Douglass, J. N. Davenport, P. K. Filbert, M. F. Finley, Wm. Jarvie, Jr., Saml. E. Knowles, D. C. Kelly, Geo. A. Mills, D. D. Smith.

SECTION IV. Operative Dentistry.—E. T. Darby, Chairman; H. J. McKellops, Secretary; W. C. Starbuck, C. W. Partridge, J. B. Coolidge, G. R. Thomas, J. W. Rhone, M. H. Webb, J. N. Farrar, Wm. T. La Roche, Benj. Lord, J. G. W. Werner, H. A. Smith, Dwight M. Clapp, W. E. Page, S. B. Palmer, S. C. G. Watkins, Jas. McManus, Jas. G. Palmer, Geo. B. McDonald, Wm. Dutch, Wm. H. Allen, G. W. Hoysradt, H. C. Meriam, J. F. Canine, I. J. Wetherbee, A. N. Priest, W. H. Goddard, M. H. Dodge, Geo. W. Keely, R. R. Andrews,

Seneca B. Brown, Joseph Bauer, Wm. Barker, C. R. Butler, A. H. Brockway, A. W. Buckland, H. F. Bishop, J. E. Blake, C. Bullock, G. C. Daboll, A. F. Emminger, Geo. L. Field, S. H. Guilford, E. S. Gaylord, W. P. Leavitt, J. U. Lee, G. S. Meigs, T. T. Moore, C. A. Marvin, S. G. Perry.

SECTION V. Anatomy, Histology, and Microscopy.—M. S. Dean, Chairman; M. L. Rhein, Geo. H. Cushing, G. F. Waters, Frank Abbott, C. F. W. Bödecker, G. V. Black, Chas. Merritt, J. F. Marriner, Henry W. Morgan, H. Eugene Smith.

SECTION VI. Pathology, Therapeutics, and Materia Medica.—Frank M. Odell, Chairman; A. M. Dudley, Secretary; A. W. Harlan, E. B. Davis, L. C. Ingersoll, Wilbur F. Litch, C. A. Brackett, C. S. Beck, C. T. Stockwell, Geo. J. Friedrichs, I. P. Wilson, E. A. Bogue, F. H. Rehwinkel, T. C. Stellwagen, Wm. Taft.

SECTION VII. Physiology and Etiology.—W. C. Barrett, Chairman; Leon Rideout, E. S. Niles, E. Hunter, J. A. Bishop, H. A. Baker, R. W. Brown, I. B. Davenport, S. E. Davenport, A. W. Freeman, S. A. Freeman, D. C. Hawxhurst, C. W. Meloney, H. B. Noble.

[Members who have connected themselves, or have been assigned to certain Sections, are at perfect liberty to present their views on any subject, in papers to be referred to the appropriate Section.—SEC'Y.]

The regular order being resumed, the discussion on Education was continued by Drs. Brophy, Hunter, Shepard, Butler, Litch, Atkinson, Abbott, and Buckingham.

On motion the subject was passed.

The time of adjournment was extended, in order that the business might be completed, and the Association adjourn *sine die.*

The following offered by Dr. Crouse were adopted:

Resolved, That hereafter, no society shall be entitled to representation in this Association that does not require its members to live up to the requirements of our Code of Ethics.

Resolved, That when it comes to the knowledge of the Committee on Credentials, that any applicant for membership is violating our Code, said applicant shall not be received, and all such applicants shall be referred by the committee to the societies whose delegates they are; and in no case shall this Association be compelled to treat with violations of the Code of Ethics, except when the violator is a member of this body, and has no membership in any local society.

On motion, it was agreed to call the Sections to order immediately after adjournment.

On motion, the President appointed Drs. Buckingham and Wetherbee to conduct the newly-elected President to the Chair, who was briefly introduced.

The Publication Committee were instructed to use their discretion in the matter of printing the Transactions, as last year.

The regular order being resumed, Section I. was called and passed.

On motion of Dr. Buckingham, the thanks of the Association were tendered to the Local Committee of Arrangements for the courtesies extended by them.

Dr. Crouse moved a vote of thanks to the retiring officers, and to the press reporters, which was carried.

On motion of Dr. Atkinson, a vote of thanks was extended to Dr. Buchanan for his remarks this morning.

A vote of thanks was passed to the proprietors of the Westminster Hotel, for the reduced rates they offered, and for the very acceptable manner of our entertainment.

The President appointed as members of the Publication Committee, Drs. Dean and Darby, and as Local Committee of Arrangements, Drs. J. Taft, Geo. W. Keely, and C. R. Butler.

The following notice of amendment to the Constitution was filed by Dr. Shepard:

To amend Article IV., of the Constitution, so as to make the present article Section 1, and to add a section as follows:

SEC. 2. The officers may, for extraordinary reasons, change the time and place of meeting upon the written consent of (10) of the fifteen (15) officers.

The minutes were read and approved, and the Association adjourned to meet in Cincinnati on the first Tuesday in August, 1882.

GEO. H. CUSHING, *Secretary.*

AMENDED CONSTITUTION,

ADOPTED AT SARATOGA, AUGUST, 1869, WITH AMENDMENTS UP TO AND INCLUDING THE SESSION OF 1882.

ARTICLE I.

NAME.—This organization shall be known by the name of the AMERICAN DENTAL ASSOCIATION.

ARTICLE II.

OBJECTS.—The objects of this Association shall be to cultivate the science and art of Dentistry, and all its collateral branches; to elevate and sustain the professional character of Dentists, to promote among them mutual improvement, social intercourse, and good feeling, and collectively to represent and have cognizance of the common interests of the Dental Profession.

ARTICLE III.

SECTION 1.—MEMBERSHIP; NUMBER OF DELEGATES FROM LOCAL SOCIETIES.—Each local society may send one for every five of its active members, and each Dental College one from its faculty as delegates to this Association for one year, upon complying with the requirements of its Constitution; but no society shall be entitled to representation that does not adopt or substantially recognize its Code of Ethics.

SEC. 2.—EXPELLED MEMBERS.—Any member of this Association being expelled or suspended from his local society, shall from that date cease to be a member of this body. [Amended 1880.]

SEC. 3.—MEMBERS TO BE OF THREE CLASSES.—The members of this Association shall be of three classes, viz: Delegates, permanent, and honorary members; the two former classes having equal rights and privileges, except eligibility to office and membership of the Sections —none being eligible to hold office except permanent members; the

latter class to consist of prominent, worthy members of the dental profession residing in foreign countries, who shall be elected by ballot.

SEC. 4.—DELEGATES.—All delegates shall be practitioners of Dentistry; they shall receive their appointment only from permanently organized Dental Societies and Dental Colleges, having definite conditions of membership other than pecuniary, which shall have been approved by the Executive Committee, and a copy of which shall be in the hands of the Recording Secretary of this body.

This Association will hereafter receive no delegate, who shall after this date, [August, 1875,] enter the profession without first having graduated at some reputable dental or medical college.

SEC. 5.—PERMANENT MEMBERS.—Permanent members shall consist of those who having served one year as delegates, and complied with the requirements of the Association, shall signify to the Treasurer a desire for permanent membership. After the resignation of a member has been accepted, the Association may at any time thereafter reinstate such member by unanimous consent. [Amended 1881.]

SEC. 6.—SIGNING CONSTITUTION.—Each new member, before voting or speaking on any subject before the meeting, shall sign these regulations, inscribing his name and the title and location of the institution from which he receives his appointment.

SEC. 7.—DUES.—Five dollars shall be paid to the Treasurer by each member yearly, as dues, before he can be eligible to office, or speak or vote on any subject before the Association; and in case the dues remain unpaid at the close of the second annual meeting thereafter, the name of any such delinquent shall be erased from the list of members without further action.

SEC. 8.—GIVING NAME ON RISING.—No one shall be permitted to address the Association before giving his name and residence, which shall be distinctly announced from the Chair; nor shall he speak more than twice, nor longer than fifteen minutes in all, unless by consent of the Association.

SEC. 9.—CONDUCT OF MEMBERS.—Any act of special immorality or unprofessional conduct committed by a member of this Association shall be referred to the Executive Committee (second division),

whose duty it shall be to thoroughly examine into the case, and report at the next meeting if the charges be sustained. Whereupon, by a vote, the offending member may be reprimanded or expelled, a two-thirds vote being required for expulsion, a majority being sufficient for reprimand.

ARTICLE IV.

TIME OF MEETINGS.—The regular meetings of the Association shall be held annually, and commence on the first Tuesday in August. The place of meeting shall be determined each year by vote of the Association. After the selection of a place of meeting there shall be appointed by the President, annually, a committee of three, residing at or near the place selected for the next meeting, whose duty it shall be to procure rooms for meetings, clinics, and for the exhibition of mechanical appliances, and to make such other local arrangements as may be needed for the Association. This committee shall act under the direction of the first Division of the Executive Committee.

[SEC. 2.—The officers may, for extraordinary reasons change the time and place of meeting upon the written consent of ten (10) of the fifteen (15) officers.

☞The above amendment offered at the session of 1881 is here inserted, as it will undoubtedly become a law at the session of 1882.—PUB. COM.]

ARTICLE V.

SECTION 1.—OFFICERS: HOW ELECTED.—The officers of this Association shall be a President, two Vice-Presidents, Corresponding Secretary, Recording Secretary, Treasurer, and the Executive Committee, who shall be elected by ballot without nomination. The three names, or in case of a tie, the four names having the greatest number of votes shall be the sole nominees in case of failure to elect on the first ballot, and a majority of all the votes cast for those names shall be necessary to a choice.

Each officer, except as otherwise provided, shall hold his appointment for one year, or until another is elected to succeed him.

SEC. 2.—PRESIDENT: DUTIES OF.—The President shall preside according to parliamentary usage, as laid down in "Cushing's Manual," and the rules of order adopted by this Association.

SEC. 3.—VICE-PRESIDENTS.—In the absence of the President, one

of the Vice-Presidents shall perform the duties of the office, and in the absence of these officers a Chairman *pro tem.* shall be appointed by acclamation.

SEC. 4.—CORRESPONDING SECRETARY.—The Corresponding Secretary shall attend to the correspondence of the Association with the societies therein represented, and to correspondence with other scientific bodies as may be desirable.

SEC. 5.—RECORDING SECRETARY.—The Recording Secretary shall keep accurate minutes of the proceedings of the Association, preserve the archives and unpublished documents, and attend to the other duties that pertain to his office. He shall be *ex-officio* chairman of the Publication Committee, and shall see that due notice is given of the time and place of meeting of the Association.

SEC. 6.—EXECUTIVE COMMITTEE.—The Executive Committee shall be the business committee of the Association, and shall consist of nine members, to whom shall be referred all business not otherwise specially provided for. They shall report at each meeting under the proper head their doings for the current year.

SUB-COMMITTEES.—FIRST DIVISION: COMMITTEE OF ARRANGEMENTS.—Three members of this committee shall act as the Committee of Arrangements, and shall procure suitable accommodations for the meetings and clinics, and for the exhibition and examination of appliances, of which they shall have the charge. These three shall attend generally to the wants of the Association during its session.

SECOND DIVISION: CREDENTIALS AND AUDITING COMMITTEE.—Other three shall examine and verify the credentials and qualifications of members, including all violations of the Code of Ethics and the Constitution, and shall also be the Auditing Committee for that year.

THIRD DIVISION: COMMITTEE ON VOLUNTEER ESSAYS.—The remaining three shall examine all volunteer essays, and before they are read to the Association shall give their approval, in order that time may not be taken up by unworthy or irrelevant matter.

They shall report the names of places for the next meeting.

PUBLICATION COMMITTEE: HOW APPOINTED.—The President shall

appoint two members of this Association, who shall act in conjunction with the Recording Secretary as the Publication Committee. They shall be authorized to employ a competent reporter to furnish an accurate report of the proceedings of each meeting.

INSTRUCTIONS TO THE PUBLICATION COMMITTEE.—They shall superintend the publication and distribution of such portions of the Transactions as the Association may direct, or the committee judge to be of sufficient value. They shall specify in the annual report of this committee the character and cost of the publications of the Association during the year, and the number of copies still on hand. Any report or other paper to be entitled to publication in the volume of the Transactions for the year in which it shall be presented to the Association must be placed in the hands of the Publication Committee on or before the first day of September, and must also be so prepared that the proof-sheets furnished the authors shall be returned to the committee without material alteration or addition.

Every paper received by this Association and all plates or other means of illustration shall be considered the exclusive property of the Association, and shall be published for its benefit. [Amended 1880.]

DISCLAIMER.—This committee is hereby instructed to print at the beginning of each volume of the Transactions the following disclaimer, viz.: "The American Dental Association, although formally accepting and publishing the reports of the various Standing Committees, and the essays read before the Association, holds itself wholly irresponsible for the opinions, theories, or criticisms therein contained, except when otherwise decided by special resolution."

REPORTS OF SUB-COMMITTEES.—Each of these sub-committees shall report from time to time, as may be necessary, to the Executive Committee as a whole, who shall decide upon such report if possible; but in case of their inability to decide upon any matter, it shall be brought before the Association for its decision as early as practicable.

CLASSIFICATION OF EXECUTIVE COMMITTEE.—At the first election of this committee, the first three shall be elected to serve three years, the second three for two years, and the last three for one year, and thenceforward three new members shall be elected each year by ballot, to serve three years, and in case of the absence of

any member of this committee his place may be temporarily filled by the remaining members of the committee.

MEETINGS OF EXECUTIVE COMMITTEE.—The Executive Committee shall, if possible, meet for consultation and arrangement of their respective duties on the day preceding the annual meeting of the Association, and shall meet for the examination of credentials, the arrangement of appliances, and the reception of papers, and such other business as may properly come before them at 8 A. M. on the day of the annual meeting.

SUBDIVISION OF EXECUTIVE COMMITTEE.—They shall also meet after the election of new members to the committee to choose their own chairman and secretary, and to divide themselves into subcommittees as hereinbefore provided, and for the purposes described.

CHAIRMAN MAY CONVENE THE COMMITTEE.—The chairman of this committee may at his own discretion summon the members thereof to a meeting at any suitable hour during the sessions of the Association.

SEC. 7.—TREASURER TO ATTEND, TO RECEIVE DUES AT 8 A. M.—The Treasurer shall hold all the moneys belonging to the Association, and shall keep an accurate account as between the society and its members. He shall attend the meeting of the Executive Committee at 8 A. M. on the day of the annual meeting to receive dues, and shall attend at roll-call to verify the list of names, checking all such as are in arrears for dues; he shall restore such names upon payment of dues within the legal limits, and shall notify all whose names may be erased from the list of membership. He shall pay the drafts of the President, countersigned by the Secretary, upon vote of the society only, and shall report to the Executive Committee, where his accounts shall be audited, and by whom his report shall be presented to the Association, together with their own.

ARTICLE VI.

SECTION 1.—To prepare, arrange, and expedite business, this Association shall be divided into seven Sections, as follows:

1. Artificial Dentistry, Metallurgy, and Chemistry.
2. Dental Education,
3. Dental Literature and Nomenclature.

4. Operative Dentistry.
5. Anatomy, Histology, and Microscopy.
6. Pathology, Therapeutics, and Materia Medica.
7. Physiology and Etiology. [Amended 1881.]

SEC. 2.—It shall be the duty of each permanent member to inform the Recording Secretary before the close of the morning session of the third day of the Annual Meeting, which of the seven Sections he elects to join for the ensuing year. He shall be free to follow his own preferences as to the particular channel in which he will labor, but can be a member of but one Section during the same year.

[But he may present volunteer papers to any of the other Sections.—SEC'Y.]

SEC. 3.—It shall be the duty of the Recording Secretary immediately after the close of the above morning session of the third day, to make out lists of the names thus furnished of each Section, as a basis for the election of officers of said Sections.

SEC. 4.—The Association shall, by vote, assign some time after the regular election of officers of the Association for the meeting of the several Sections for organization.

SEC. 5.—When the time for the organization of the Sections has arrived, it shall be the duty of the Recording Secretary to furnish some one member of each Section with the list of members of his respective Section, which member shall thereupon call the members to order and read the list of names. The members shall then elect by ballot a chairman and such other officers as they may see fit.

SEC. 6.—The chairman shall preside at all the meetings of his Section; shall exercise general supervision over the business, and shall see that the labors of his Section are conducted in the manner calculated to secure the best results. The chairman, or such other member or members as the Section shall select, shall prepare and read at the annual meeting of the Association next ensuing a paper or papers on the advances and discoveries of the past year in the branches included in the Section. The reading of such papers shall not together occupy more than forty minutes.

SEC. 7.—The several Sections shall meet at 10 A.M. on the morning of the first day of the annual meeting of the Association.

SEC. 8.—For the information of all members, a list of the members of each Section shall be published in the Transactions of each year.

ARTICLE VII.

QUORUM.—Fifteen members shall constitute a quorum for the transaction of business in this Association.

ARTICLE VIII.

SUSPENDING RULES: THREE-FOURTHS TO VOTE.—This order of business may be temporarily suspended by a three-fourths vote of all the members present, for the consideration of a specific subject, upon the completion of which the regular order shall be at once resumed.

RULES OF ORDER.

1. On the arrival of the hour of meeting, the President shall take the chair, call to order, and announce that the meeting is open for business.

2. No motion or speech shall be in order until the mover or speaker shall have been recognized and assigned the floor by the Chair, nor shall a motion be open for debate until seconded and stated by the Chair.

3. At the request of any member a motion shall be put in writing.

4. At the request of five members a question shall be divided, or the yeas and nays ordered.

5. When a question is under debate, no other motion shall be in order, except—1st, to adjourn; 2d, to lay on the table; 3d, the previous question; 4th, to postpone; 5th, to commit; 6th, to amend; and these motions shall take precedence in the order here stated.

6. The previous question, and the motions to adjourn, to lay on the table, and to postpone, shall be decided without debate.

7. A motion to adjourn shall always be in order, but no member can make such a motion while another is speaking, or while a vote or ballot is being taken.

8. A second amendment to the main question shall not be in order until the first is disposed of, nor shall there be an amendment of an amendment to an amendment.

9. After a motion has been seconded and stated by the Chair, it shall not be withdrawn without the consent of the Society.

10. No member shall interrupt another while speaking, except to call him to order.

11. When called to order, a member shall sit down until the point of order is decided by the Chair, or, in case of appeal, by the Society. If the point of order be sustained, the member can proceed in order by the consent of the Society.

12. Every member shall vote upon a question unless excused by the Society.

13. When any motion, except to adjourn, has been rejected, it shall not be renewed without unanimous consent.

14. Any member who voted in the majority may move a reconsideration of that question, but if that motion shall be lost or laid upon the table, it shall not be renewed without unanimous consent.

15. The President may vote with the members upon all questions, but having so voted, shall not give the casting vote in case of a tie.

16. Motions for filling blanks shall be put in the order in which they are moved.

17. On a division, or in voting by yeas and nays, any member may change his vote before the result is declared.

18. These rules may be suspended by unanimous consent.

ORDER OF BUSINESS.

1. Meeting of the Executive Committee, filling of vacancies therein, examination of credentials, and payment of dues, 8 A.M.

2. Meetings of the Sections at 10 A.M.

3. Organization of the Association at 11 A.M.

4. Calling the roll of qualified members.

5. Reading of the minutes and action thereon.

6. The reading and consideration of the stated annual reports from the Sections, together with volunteer papers upon the same subjects in their consecutive order.

7. Report of Executive Committee.

8. Balloting for the place of next annual meeting.

9. Election of officers and three members of Executive Committee.

10. Instructions to the permanent committees.

11. Unfinished, new, and miscellaneous business.

12. Adjournment.

AMENDMENTS.

Alterations and amendments may be made in the foregoing Articles or Rules of Order at any annual meeting, by the consent of all the members present. Otherwise notification in writing shall be made of any such proposed alterations or amendments, and laid over for one year for final action, when they can only be adopted by an affirmative vote of two-thirds of the members present.

STANDING RESOLUTIONS.

The following standing resolutions are in force at this time, August 1, 1882.

Resolved, That henceforth no person shall be received as a delegate who is in arrears for dues, or until he has paid to the Treasurer the full amount due at the time his name was dropped for non-payment.

Adopted August, 1874.

Resolved, That hereafter no dental college shall be entitled to representation in this Association that does not require a good English education as a preliminary qualification for its matriculants, to be ascertained by examination.

Adopted August, 1879.

Resolved, That in order to secure representation in this Association, dental colleges must, subsequent to October, 1881, require all students entering therein to take two full courses of lectures previous to coming forward for examination and graduation, and must also state these conditions in their next annual announcement.

Adopted August, 1880.

Resolved, That hereafter no society shall be entitled to representation in this Association that does not require its members to live up to the requirements of our Code of Ethics.

Resolved, When it comes to the knowledge of the Committee on Credentials that any applicant for membership is violating our Code, said applicant shall not be received, and all such applicants shall be referred by the committee to the societies whose delegates they are, and in no case shall this Association be compelled to treat with violations of the Code, except where the violator is a member of this body and has no membership in any local society.

Adopted 1881.

Resolved, That the Secretary be instructed to assign members who may neglect to make their own choice the Section in which they are expected to work.

Adopted 1879.

Resolved, That the reports of Sections shall be called by the President in consecutive order, beginning each succeeding year one number higher than on the preceding year.

1879	commencing	with	No. I.
1880	"	"	No. II.
1881	"	"	No. III.
1882	"	"	No. IV.
1883	"	"	No. V.
1884	"	"	No. VI.
1885	"	"	No. VII.
1886	"	"	No. I.

Adopted 1879.

CODE OF DENTAL ETHICS.*

ARTICLE I.

THE DUTIES OF THE PROFESSION TO THEIR PATIENTS.

SECTION 1.—The dentist should be ever ready to respond to the wants of his patrons, and should fully recognize the obligations involved in the discharge of his duties toward them. As they are, in most cases, unable to correctly estimate the character of his operations, his own sense of right must guarantee faithfulness in their performance. His manner should be firm, yet kind and sympathizing, so as to gain the respect and confidence of his patients; and even the simplest case committed to his care should receive that attention which is due to any operation performed on living, sensitive tissue.

SEC. 2.—It is not to be expected that the patient will possess a very extended or a very accurate knowledge of professional matters. The dentist should make due allowance for this, patiently explaining many things which may seem quite clear to himself, thus endeavoring to educate the public mind so that it will properly appreciate the beneficent efforts of our profession. He should encourage no false hopes by promising success where, in the nature of the case, there is uncertainty.

SEC. 3.—The dentist should be temperate in all things, keeping both mind and body in the best possible health, that his patients may have the benefit of that clearness of judgment and skill which is their right.

ARTICLE II.

MAINTAINING PROFESSIONAL CHARACTER.

SECTION 1.—A member of the dental profession is bound to maintain its honor, and to labor earnestly to extend its sphere of usefulness. He should avoid everything in language and conduct calculated to discredit or dishonor his profession, and should ever manifest a due respect for his brethren. The young should show special respect to their seniors; the aged special encouragement to their juniors.

* Adopted August, 1866.

SEC. 2.—The person and office arrangements of the dentist should indicate that he is a gentleman; and he should sustain a high-toned moral character.

SEC. 3.—It is unprofessional to resort to public advertisements, such as cards, hand-bills, posters, or signs calling attention to peculiar styles of work, prices for services, special modes of operating, or to claim superiority over neighboring practitioners; to publish reports of cases, or certificates in the public prints; to go from house to house soliciting or performing operations; to circulate or recommend nostrums, or to perform any other similar acts. But nothing in this section shall be so construed as to imply that it is unprofessional for dentists to announce in the public prints, or by card, simply their names, occupation, and place of business; or in the same manner, to announce their removal, absence from, or return to business; or to issue, to their patients, appointment cards having a fee bill for professional services thereon.

SEC. 4.—When consulted by the patient of another practitioner the dentist should guard against inquiries or hints disparaging to the family dentist, or calculated to weaken the patient's confidence in him; and, if the interests of the patient will not be endangered thereby, the case should be temporarily treated, and referred back to the family dentist.

SEC. 5.—When general rules shall have been adopted by members of the profession practicing in the same localities, in relation to fees, it is unprofessional and dishonorable to depart from these rules, except when variation of circumstances requires it. And it is ever to be regarded as unprofessional to warrant operations or work as an inducement to patronage.

ARTICLE III.

THE RELATIVE DUTIES OF DENTISTS AND PHYSICIANS.

Dental surgery is a specialty in medical science. Physicians and dentists should both bear this in mind. The dentist is professionally limited to diseases of the dental organs and the mouth. With these he should be more familiar than the general practitioner is expected to be; and while he recognizes the superiority of the physician in regard to diseases of the general system, the latter is under equal obligations to respect his higher attainments in his specialty. Where this principle governs, there can be no conflict, or even diversity, of professional interests.

ARTICLE IV.

THE MUTUAL DUTIES OF THE PROFESSION AND THE PUBLIC.

Dentists are frequent witnesses, and at the same time the best judges, of the impositions perpetrated by quacks, and it is their duty to enlighten and warn the public in regard to them. For this and the many other benefits conferred by the competent and honorable dentist, the profession is entitled to the confidence and respect of the public, who should always discriminate in favor of the true man of science and integrity, and against the empiric and impostor. The public has no right to tax the time and talents of the profession in examinations, prescriptions, or in any way, without proper remuneration.

ANNUAL ADDRESS.

By C. N. PEIRCE, President.

Gentlemen of the American Dental Association:

We have met this year under unusual conditions, our Association having been convened almost a month earlier than has been customary, in order that those of its members who wish may have the opportunity of accepting an invitation to attend an International Medical Congress meeting in London, without absenting themselves from this our annual gathering. While this invitation to the dental profession in America indicates a change in the estimate of the American dentist, and should therefore be received with a degree of satisfaction and pleasure, yet considered in connection with similar advances at home, it should cause anxiety as to the possible influence which it may have upon the future of our profession. Casting a retrospective glance to a period not far distant, and from thence following step by step each progressive effort, noting the obstacles that have been overcome, and the successive positions attained, each giving a broader view and opening up a wider field of labor and thought, we cannot fail to see that during this period there has been no more persistently indifferent and unappreciative class than those who now invite us to share in their deliberations. These overtures on the part of the medical profession are certainly gratifying, so far as they indicate that the dental profession has gained a definite position in the ranks of the healing art.

That we can meet with the medical profession to our and their advantage I firmly believe. But to be thus profitable the meeting must not depend on titles and degrees purchased or conferred, but must result from an appreciation of knowledge acquired by industrious, persevering, and original research. Titles and degrees conferred until the alphabet is exhausted are but as stones to the neck of a drowning man, or as voluminous and eulogistic epitaphs upon the gravestone of a criminal; the one excites derision and disgust, the other is a serious obstacle in the way of life. The late movement on the part of some of the medical schools in instituting additional chairs for the purpose of giving instruction in dentistry, would be entitled to more

confidence and favor had the medical profession shown any appreciation of the requirements of the dentist; of the field for study which dentistry offers; of the fact that the organs and adjacent tissues with which we have to deal possess anatomical and physiological connections, liable to a wide range of pathological sympathies and complications; that even in the microscopic tooth-germs are wrapped up inherited physical, mental, and moral peculiarities; that in no organs or tissues more than in the teeth is there a greater tendency to reproduce parental characteristics; in none are imperfections in structure and predispositions to disease more certainly transmitted; in none are systemic conditions more readily impressed, and that for the observation of these physiological and pathological peculiarities no occupation affords a better opportunity than that of the dentist.

That the medical profession has never appreciated and does not now appreciate the requirements of the dentist is made patent by the fact that upon a partial and very limited medical education, its colleges are yearly conferring degrees in dentistry with all of the rights and privileges pertaining thereto, while the ophthalmologist, dermatologist, obstetrician, and gynæcologist, as well as the aural surgeon, must all take a full course of medicine and receive the degree of M. D. before they can be recognized in any of the above specialties.

Is there in the practice of any one of these specialties sympathetic nervous relations more serious than those accompanying many conditions of the teeth, and especially those occurring during the formative and eruptive period of dentition, a period during which it is an undisputed fact that the greatest number of deaths occur among children?

Twenty annual meetings have been held since this Association was evolved from The American Dental Convention. The pertinent inquiry now is, Have our yearly gatherings been sufficiently fruitful to compensate for the separation?

A brief résumé of our work and growth would, if time permitted, be a matter of interest to the younger members, but we must be content with noting a few evidences of progress.

Our meetings, which were at first largely occupied with papers and discussions on means and methods, with only an occasional paper beyond these limits, are now, in addition to such, treated every year to essays based on original research, indicating methodical study, a wider range of thought, and a higher degree of culture.

The Sections of Anatomy, Physiology, Histology, and Microscopy, of Pathology, Therapeutics, and Materia Medica, of Dental Education and of Dental Literature, have each, as they have in turn been called upon, responded with creditable reports upon these subjects, of especial worth as indicative of future work and attainment.

While we note with pleasure what has been accomplished in the past, there yet remains a large field for investigation and an immensity of work to be done.

Economy of time, greater care in the selection of topics, and the limiting of discussion on unimportant subjects, will greatly facilitate our proceedings and add interest to our sessions. In proof of the necessity for this let me refer to an occurrence or two of last year. In one instance a large portion of one session was consumed in discussing the propriety of reinstating an old member; and in another two full sessions were occupied (the report embracing twenty pages of our printed proceedings) in remarks largely confined to the relative value of adhesive and non-adhesive gold foil, whereas every skillful operator recognizes the fact that equally good and satisfactory work can be done with each; that the results depend more upon the skill and judgment of the operator than on the material used; and also that, however much we may be by education and experience attached to gold, we must admit that there are more teeth saved with what are known as plastic fillings than with gold; that an eclectic practice is to be preferred to one in which an exclusive and hurtful discrimination against any material of value obtains.

Among the subjects of importance to the public as well as to the practicing dentist, there is one that has been almost wholly neglected by the numerous essayists who have contributed to our pleasure and instruction. I refer to that of Etiology—the science of the causes of dental caries. Little has been written and nothing systematized or formulated respecting the all-important factors in the production of the almost universal disease which results in the destruction of tooth-tissue. It is true we constantly allude to caries of the teeth as being due to exciting and predisposing causes. We go further, and with much confidence state that the exciting cause is the presence of a vitiated saliva induced by local and systemic conditions; that the predisposing causes are vices of conformation occasioned by imperfect or improper nutrition during the period of calcification.

These represent a very limited number of the various influences

which are constantly operating against the durability of the teeth. With a more liberal education, and more time to devote to this line of investigation, I trust we shall much more fully appreciate hereditary, physiological, pathological, and dietetic influences.

We may derive valuable information from observations upon the lower animals, especially upon the effects of treatment of domestic animals in changes of food, habits of life, etc.

The relations existing between the mandibular or lower-jaw movements and tooth-forms are not ideal, but real, and are dependent to a great extent upon the mode of use of the parts, and the force exerted. It is also true that those animals which live upon the toughest and most solid food, have the most deeply implanted teeth and the most effective arrangement for the replacement of tooth-structure when lost by wear. In the examination of the jaws and teeth of lower animals we find that with the simplest type of jaw-movement, which is that where the mouth is simply opened and closed in a vertical line without any lateral or horizontal movement, there exists the simplest tooth-form, and that with increasing complexity of the lateral movement, there is an increased complexity of the enamel foldings, ridges, and crests of the tooth-crown.

It is also apparent that incisor teeth are partially or entirely absent in animals which have long prehensile tongues, mobile, prehensile lips or probosces. It is more than probable that this undue development on the part of these organs, and the disappearance of the dental element, is due to the absence of function on the one part, and to increased function on the part of the soft structures.

"There is then a constant relation between use and strength of the part used, which needs no other explanation than such as will recognize the force excited by the muscles of any animal as a retro-active stimulus evoking development of strength, not only of the muscles, but of the sclerous or hard tissues, whenever needed, and conversely, causing degeneration or retroaction of development in parts not exercised."

The above facts, together with illustrations which may be deduced to sustain them, make it safe to conclude that the almost universal prevalence of dental caries, and many other oral deformities, are in a large measure due to the increasing use of soft foods, and to a want of proper use of the teeth in comminuting harder and drier pabulum, the proper trituration of which would be an active stimulant, tending to produce a healthier and stronger development of tooth-structure. A letter before me from that indefatigable worker, Henry

Bergh, states that exclusive and continuous excessive slop-feeding of cows not only loosens the teeth but causes them to fall out, and tends to inflammation and sloughing of the gums. The experience of every practical dentist cannot fail to make him fully cognizant of the marked difference in the teeth of those who live upon dry, solid food and those subsisting largely on fluids and semi-solids. Visits to the various institutions where the inmates are detained and protected, offer excellent opportunities for the examination of the teeth, and for noting the influence upon them of the warm drinks which soften and wash into the stomach food without mastication.

The increasing care and trouble which the dentist experiences in the successful treatment of a young miss's teeth, while she is preparing for competitive examinations and promotion at school; the exalted sensitiveness of the teeth during the period of gestation and lactation; the almost uniform certainty of the loss of two or more teeth by the average mother for every child nursed,—these and many other conditions with which every dentist of experience must be impressed, speak to the profession in unmistakable language of the inefficiency of all methods based entirely on manipulative skill.

In conclusion I beg leave to offer the suggestion, that the Section embracing Etiology organize a voluntary committee, which shall at once commence a careful and systematic investigation with the view of ascertaining as far as possible the causes which contribute to the almost universal existence of dental caries. I believe it quite possible for this body in a year or two to say to the public that there are certain physical, mental, moral, and dietetic causes which are contributing both directly and indirectly to the prevalence of this condition, which is so destructive of health and beauty.

SECTION III.

DENTAL LITERATURE AND NOMENCLATURE.

REPORT ON NOMENCLATURE AND TERMINOLOGY, BY W. H. ATKINSON, CHAIRMAN.

FOR our present installment of universological science in its application to histological and anatomical particulars, we cannot do better than recur to the fundamental discrimination of FORM, quoted two years ago, and re-quoted last year. This is as follows:

1. PUNCTIFORM.
2. LINIFORM.
3. PLAINIFORM.
4. SOLIDIFORM.

It must now be added that Universology demonstrates that *all classifying discriminations in all spheres of Being* go back, for their origin, to the department of Form (or shapes), and that (particularly for our present purpose) there are, fundamentally, four grand systems of distribution, and consequently of appropriate classification of all the generals, specials, and detailed particulars of the human body, following precisely this fundamental four-fold discrimination of the varieties of form; and as the point, the line, the plane, and the solid rise one above the other, from the point onward, in the order of their increasing complexity, so that order of classification within the body which is developed upon, and which represents the point or punctiform, is the most minute, and is the primitive or elementary one, and is, in fact, therefore, the HISTOLOGICAL, or microscopico-anatomical domain; while the remaining three systems rise above, envelop, and, as it were, obscure or conceal it.

In addition to all this, there is the combination, in the totality of the structure, of all these varieties of form in a complicated *mikton*, or admixture of parts, which are partially smelted into a complicated mass, artistically modified or molded into each other—for Nature herself has her artistic (or artismal) department in the final finish of things, as well as her naturismal department in their first crude massing, and her scientismal department in their regular and

schemative outlay. For the artistic blending of parts in the finish of structures, Stephen Pearl Andrews has furnished the expressive and valuable new technicality, COMPLASTICATION (or, if it be preferred as more purely Greek, *symplastication*).

The two side-halves of the entire brain, for instance, were, in the primitive outlay or original ideal of brain-structure, each a complete sphere or globe-shaped body; which spheres being co-aptated, or placed and pressed against each other, became hemi-spheroid, and then by being pressed out in some directions, retracted in others, everted, convoluted, and, as it were, kneaded into the requisite shape for their ultimate uses, the brain, as a whole, results in being spheroid, or proximately a single sphere; the primitive spheres having subsided into hemispheres. This ultimate and complicated modification of form is, in the final shape, an instance of complastication.

From out of the blended mass of the finished structure we have to rescue, as it were, and discover the minute and elementary parts. These are in a general sense the tissues, and the still more primitive corpuscles and fibers. For this department of investigation we resort to the microscope.

As to the objects to be investigated under the microscope, none is so interesting and important as the embryo, the most ready and easy access to which we have in the case of the development of the chick, in the hatching of the common hen's egg. Embryology and histology here meet, and so we are, as it were, at the center of anatomical affairs, and especially as they chiefly concern us professionally. And now come Universology and Alwato to preside over classification and nomenclature, which we must now glance at again, as they affect matters at this fountain-head of biological science.

The Alwato word for the human body is HOBODO. If we add to it the syllable, -BO, which again signifies embodiment (making hobodo, bo), the further addition to this stem-word of certain leading consonant sounds will then denote the several kinds of substance (as tissues, organs, etc.) of which the body is composed. Observe, however, that among these *arrangements* the joints (denoted by P) are included, thus:

Hobodo,bō,ng; cartilage.
Hobodo,bō,n·go (bōng-go); bone.
Hobodo,bō-ndlr,io; sinew.
Hobodo,bō,b,io; muscle, etc. (especially bo,ndr,io for contractility).
Hobodo,bō,v,io; secretory substance.
Hobodo,bō,p,io; joint.
Hobodo,bō,fr,io; nerve.

Add to this the following meanings assigned to the accompanying letters and syllables:

K; cut, division.
M; out.
N; in.
Go; shaft, or trunk-like process.
Do; head, or knob-like object.

In what here remains to be said, we shall have to deal mainly with BŌNG and BŌN·GO (cartilage and bone), and with the added letters and syllables, K, M, N, GO, DO. With these elements we shall effect the following embryonic classification.

Let us, however, combine the first and last members of the foregoing catalogue into the BŌNGF,IO (cartilage-nerve-blood-mass=myxomatous tissue), to denote the primitive mass of organifient materials, behaving somewhat like cartilage and somewhat like nerve-matter (neural mass), out of which the pronounced tissues and organs subsequently emerge. Or, to avoid complication, we may here treat this primal organized mass as cartilage in a primitive state, employing the name BŌNG(IO), tracing its differentiation into bone and the other organic aspects of the incipient being. It is not so much histological precision which is here important, as it is illustration of the new method of naming the discriminated parts, however classified, which Alwato places at our disposal.

The Alwato word for *first* is Çīs(o), pronounced *tshees(o)*; -I,TŌZ (*-ee-tōz*) is a plural diminutive ending; and so BŌNG,I,TŌZ will mean little masses of cartilaginous or cartilage-like (chondroid) matter; and çīs,BŌNG,I,TŌZ will be and is the true naming for the "proto-vertebræ," "somites," the primitive plates, chondroids, or gristles.

The K-sound denoting CUT or DIVISION, BŌNG,KI,TO (1) is the "primitive trace" or slit along the middle between the bōng,i,tōz.

Bōn·g,i,tōz are then the lateral ridges along the edges of the primitive trace (bōngito).

Bōmn,io is the blastoderm or blastodermic membrane, *out-in*-plates.

Bōm,io; out-plate is the "ektoderm."

Bōn,io; in-plate is the "endoderm."

Bōng,ōn is the furrow between the bōn·g,i,tōz.

Bōng,ōm is the closed and combined bōng,i,tōz; the incipient vertebral column, apart from its contents; the closed cavity to contain the brain and the spinal cord.

NOTE.—(1) When the sound NG, for which we have no single letter in the English alphabet, occurs before the hard G-sound (as in give) or before K, it is represented by N· instead of NG, to avoid the awkward combinations NGG and NGK. The difference between NG and N·G is that between the NG in *singer* and in *finger* (=*fingger*).

Bōngrōng is the vertebral column, and its cavity and *its* contents confusedly or indiscriminately regarded.

Bōng,ōn,in is the spinal cord (what is *in* the bōng,ōn).

Bōng,ōn,in,do; the fetal brain (-DO=head of).

Bōng,ōn,in,go; the spinal-cord proper, *minus* the brain.

Bōng,ōn,in,go,do is the *medulla oblongata* (the head of the spinal cord proper).

Bōmn,i,ōmz are the dorsal plates of the blastodermic membrane.

Bōmn,i,ōnz are the abdominal plates of the blastodermic membrane.

Bōn,io,sta is the endodermic system, the development of the internal layer of the blastodermic membrane known as hypoblast, from the upper side of which a proliferation of indifferent corpuscles gives rise to the mesoblast of the books; but this origin of the mesoblast is not constant, for it sometimes arises from a like proliferation of indifferent corpuscles from the under side of the epiblast, thus presenting us with a double origin of this source of specialized metabolism. In one and the same embryo it is often produced by a conjoint proliferation from the two layers, epi- and hypo-blast. To come, here, within appropriate limits, the specific namings in this degree of detail are omitted:

Bōn,iōn is the abdominal or hæmal cavity.

The preceding exhibit is embryonal and special. To render it more thoroughly intelligible on both the phonetic and the physiological sides of it, the following additional elaborations will be of essential service:

I.

CONSONANTS AND THEIR MEANINGS.

D; head, knob.
G(hard); trunk, shaft, process. } B; body; *deadness*-build.

Z; group, mulberry-form (herd, flock).
Zh; embranchment, tree-form, arboraceousness. } V; organ; *liveness*-build.

T; unition, rivet.
K; division, divarication. } P; joint, hinge.

S; constellate form.
Sh; radiate form. } F; fan-shape, plexus.

M, out; N, in; Ng, neutral, between; L, whole; R, part; (W, wavy, doubtful; Y, assertory, positive; H, attenuated, breathy, hæsitive, hesitating; see below.)

II.

Stated in a somewhat different order, mixed in with a few combinations, and with approximations of their meanings on the one hand towards their lingual, and on the other hand towards their physiological meanings, the list may be re-presented after this manner:

W; question, hemispherism, bilateral symmetry.

Y; answer, *septum lucidum*, septum of the bilaterism.

H; hush, breath-holding, silence; breath, *halitus* (spirit-like).

L; wholeness, whole-ism, unbrokenness, continuousness, string-likeness, permanency.

R; partness, brokenness, discontinuousness; lax, fluxy, periodicity-like, temporary.

M; affirmation, YES, outness, exteriority, bigness.

N; negation, NO, inness, interiority, littleness.

Ng; neutrism, indifference, neitherness, passing over into obstinate or persistent, *successfully affirmed-and-negated* assertion, unstable and indeterminate but each way assertory equilibrium; elasticity, *cartilagism*.

N·g(=ng+g); out-along-ism, persistent or determinate affirmation or negation; hardness, bone-ism or bone property.

G; produced shaftism; bone form.

Nd; in-head-ism, single contractile lumpism; *muscle-ism*.

D; head, bulb, or knob-like object or form.

Mb; affirmative or external mass-presentment.

B; bludgeon or mace-shaped object, shaft with bulbous end, *deadness*-like presentment.

V; *liveness*-like presentment, complex mass-presentment (cysts and tubes), *glandism* (epithelial, secretory, etc.)

Z; congeries of cysts; animaloid (flock, herd-like).

Zh; congeries of tubes; vegetaloid (tree, plant-like).

P, Nt, N·k, Mp; hingings, joints (syndesmological).

F; complex and multiplex minutiæ, confluent and dispartive.

Fl; fluidity, water-like presentment; blood, etc.

Fr; fractility, reflective, refractive, radiative, light-like presentment; *nerve* (intelligence, inter-ligence, *the-gather* or the entire system).

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III.

Still again re-arranged, with more immediate and special reference to physiology (and running mostly in connection with the vowel o), the consonant distribution reappears as follows:

Bōl,io; the androideum (a new coinage to denote trunk, head, and neck).

Bōr,io; the *limbi* (or limbs as detached or considered apart from the trunk).

Bōlr,io; the appendiculæ—the limbs or appendicular portions of the body, considered as attached to the androideum, and hence as implying it, and so, by inference, meaning *the whole body*, with this particular composition (androideum and limbs).

Bōm,io; the body walls (literally outness-dom or walls-dom), the ektodermic system, the development of the outer layer of the blastodermic membrane.

Bōn,io; contents of the body walls, the endodermic system, the development of the internal layer of the blastodermic membrane=bo,hwau,io.

Bōng,io; neutral mass, CARTILAGE, gristle, chondroid mass.

1. Bōng,l,io; permanent cartilage.
2. Se,bōng,l,io; non-articular permanent cartilage.
3. Bōng,r,io; temporary (*i. e.* inter-rupt-ory) cartilage.
4. Bōng,lr,io; articular permanent cartilage.

Bōn·g,io (=bōng,ghi,o); BONE (bōn·g,io,sta; bony system, skeleton).

1. Bōn·g,l,io; ossein or bone cartilage (in close relation with bōng,l,io).
2. Bōn·g,r,io; bone-ash when separated.

3. Bōn·g,lr,io; the bone-ash substance in its normal connection with the ossein.
4. Bōg,io; shaft-like structure, bone-shape (closely allied with bōn·g,io).

Bōnd,io; MUSCLE (in-heading, bunchy, contractile).
1. Bōnd,l,io; smooth or non-striated muscle.
2. Bōnd,r,io; striped or striated muscle.

Bōnd,lr,io; SINEW, fibrous tissue.
1. E,sa·s,bōnd,lr,io (*ay-sas*, etc.); yellow or elastic fibrous tissue.
2. O,sa·s,bōnd,lr,io; white or non-elastic fibrous tissue.
3. U,sa·s,bōnd,lr,io (*oo-sas*, etc.); fibro-cartilage.
4. Bōd,io; head-like, bunch-like, contracted muscle-shaped structure (closely allied with bōnd,io).

Bōmb,io; mass-presentments, external embodiments of bone and muscle (butchers' meat type, etc.)
1. Bōmb,li,o; integral mass-presentments.
2. Bōmb,r,io; fractional mass-presentments.
3. Bōb,io; inert, *deadness*-like, cadaver-like sustentory mass, bone, muscle, etc., as contrasted with bōv,io (see below), the liveness-mass. Bōb,io is closely allied with bōmb,io.

Bōv,io; GLANDS, glandular and special organic mass, *liveness*-mass (as contrasted with bōb,io above); glandular, secretory, epithelial; special-sense organs, etc. (The major physicoid, or life-bearing system, tissues, and organs.) Cystoid-and-tubuloid.
1. Bōzh,io; the vegetaloid or predominantly tubuloid, glandoid-mass.
2. Bōz,io; the animaloid or predominantly cystoid, glandoid-mass.
3. Bōv,l,ia; secretion.
4. Bōv,r,ia; excretion.

Bo,vau,i,hwau,io; glandoid and *liveness* organ(ism)s.
I. Bō,v,au,io; systemic and special organs (extra-visceral).
Vīts (*veets*); cells (zhītsvegetaloid) and corpuscles (zhītsanimaloid).
Vēts (*vayts*); fibers, living strings, and other thread-like organs.
Va·ts (*vats*); membranes and membranoid expansions; the skin, in pre-eminence, the seat of palpation or the sense of touch.
Vat (*vaht*); thick-th or brawn-like; seat of the muscular sense.
V·u,bo (*vuhbo*); the nose, organ of the sense of smell.
V·o,bo (*vaw-bo*); the ear, organ of the sense of hearing.
Vo,bo; the eye, organ of the sense of sight.
Vu,bo (*voo-bo*); the tongue, organ of the sense of taste.
II. Hwau,io; the viscerismus, the total aggregate of the visceral organs. (Will be distributed in a subsequent report.)

Bōn·k,io; joints(bon·k,io,ski; syndesmology).
1. Bōn·k,l,io; ligaments.
2. Bōn·k,r,io; synovial membranes.
3. Bōn·k,r,ia; synovia.
4. Bōn·ks; the sundering fissures or clefts of the joints.
5. Bōnts; the unitions or *joinings* of the *joints*.
6. Bōps; hingings, the meeting-and-divisional aspects of joints.

7. Bōmps; joints (bōps) especially as seen from outside, as swellings or protuberances; whence also bōmps (bumps) for any similar protuberances, phrenological, etc.

Bōf,io; *glanduloidity* (the minor counterpart of bōv,io). For this, as embracing the circulations in a very general sense, the new technicality *glanduloidity*, as if imitating the glands (compare the heart and the brain with the liver), has been adopted.

I. Bō,fl,io; fluidity (gland juices, etc.)

1. Bōsh,l,io; slushy or crude fluids or liquids, plasmas, peptones, emulsions, leakages, lymphatic, lacteal, etc. Minor physicoid or life-bearing system. PROTOPLASM.
2. Bōs,l,io; *developed* fluids, blood, serum, mucus, oil, tears, etc. (Bōs,l,l,io; venous blood. Bōs,l,r,io; arterial. Bōs,l,lr,io; capillary.

II. Bō,fr,io; NERVE, stella-solar-and-radiant-mass; the physicoid life-bearing (or mentoid) system, tissues, etc.

1. Bōsh,r,io; the sympathetic nerve system, tissue, etc.
2. Bōs,r,io; the cerebro-spinal nerve system, tissue, etc.
3. Bō,fr,r,io; the gray matter.
4. Bō,fr,l,io; the white matter.

In addition to the preceding technicalities, Mr. Andrews has furnished your committee with the following diagrams with their accompanying explanations from unpublished manuscript works.

DIAGRAM I.

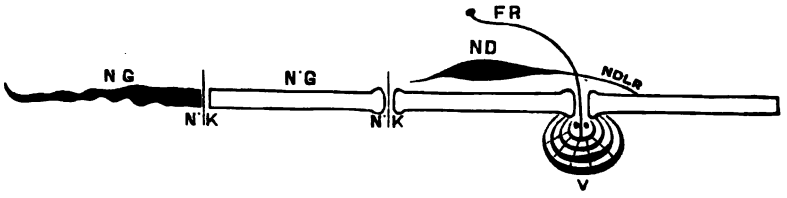
Illustrating the ideal or typical origin of bone and joint from the prior chondroid mass.

EXPLANATION.

ng; chondroid, cartilage, or gristle.
n·k; crack, crevice, or cleft; incipiënt joint.
n·g; bone, hardened cartilage; articulated mass.

DIAGRAM II.

The same with increased elaboration.



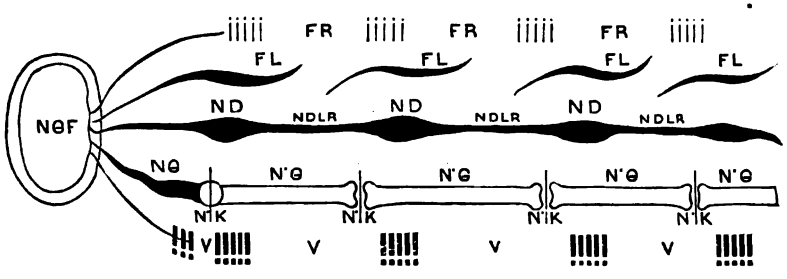
EXPLANATION.

ng; cartilage.
n·k; joint cleft.
nd; muscle, contractile mass.
fr; incipient nerve, simulating the ray of light through the cleft.
ndlr; the sinew (tendon); breaking joints and connecting.
n·g; bone; the hardened shaft with headings or bulbous-ends of its own; bludgeon-shaped.
v; gland, synovial exudent, bursal, secretory, epithelial, *bud-like* or *liveness*-like; organicoid, splanchnoid, and limitary; the specially vitalic domain; the exact analogue of the *bud* (seated at the joint) in vegetal anatomy; whence the French *bourgeon*-(*i.e.* bud-)shaped.

DIAGRAM III.

Larger view of the primitive type forms of the tissues and joints, developing from the still prior myxomatous mass.

The *ngf*, *ng*, *n·g*, and *ndlr* are collectively called connective tissue by Carl Heitzmann and perhaps by some other German histologists. The term is vague and undefined with other authors.

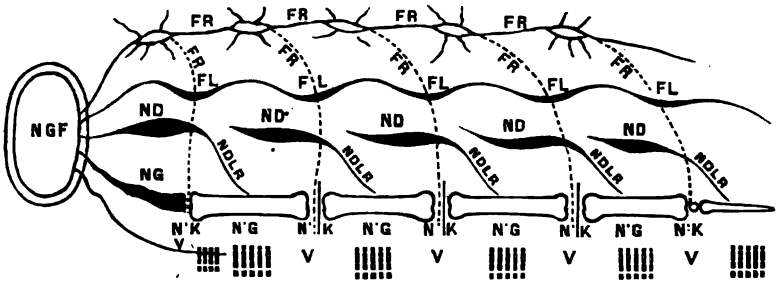


EXPLANATION.

ngf; myxomatous or embryonal tissue, undifferentiated blood, nerve, connective tissue, etc., out of which the specialized tissues arise. A sample of this primitive tissue remains in the gums, even of the adult, of which they are mainly composed.
ng; cartilage.
n·k; joint.
n·g; bone.
nd; muscle.
ndlr; sinew.
fl; fluid.
fr; nerve.
v; gland.

DIAGRAM IV.

Primitive type-forms of tissue, etc., modified by nature's ARTISTIC MODIFICATION, towards their actual condition *in situ*.



EXPLANATION.

With allusion to the corresponding telluric or cosmic structure.

ngf; myxomatous tissue—primitive earthy chaos.
ng; chondroid mass—petroids, clays, etc.
n·k; joints—clefts, seams, "veins."
n·kr; synovia—metallic ores in rock-veins.
n·g; bone—rock.
nd; muscles—soils, loams, etc.
ndlr; sinew—asbestos, rock-fibers.
fl; fluid, blood, etc.—water, streams, etc.
fr; nerve—solar and stellar light.
v; glands, organs, etc., vitalic—vegetal and animal kingdoms.

Of the preceding discriminations the following six are usually assumed as the most governing under the double name of tissues and systems:

1. Bōng,io; cartilage.
2. Bōn·g,io; bone.
3. Bōnd,io; muscle.
4. Bōnd,lr,io; sinew (tendon, etc.)
5. Bōv,io; gland (secretory, epithelial, etc.)
6. Bō,fr,io; nerve.

To these if we add the syllable, *-web*, we name them as TISSUES, or according to their fine internal structure; and if we add to them the suffix, *-sta*, signifying system, we name them as systems; thus, bōnd,io,web, the muscular tissue; bōnd,io,sta, the muscular system, etc.

In conclusion, the following are the Alwato namings for the principal divisions of biological and medical science:

Bodo,b(io),ski; anatomy.
Bodo,v(io),ski; physiology.
Bodo,hal,ski; hygiene.
Bodōr,ski; surgical pathology.
Bodōlr,ski; medical pathology.
Bodōl,ski; surgical therapeutics.
Bodōrl,ski; medical therapeutics.
Bodo,bau,ski; direct anatomical, ingrediential departmentology.
Bodo,bo,ski; anatomy proper, anatomical promorphology.
Bodo,bu,ski; anatomical mechanics.
Bodo,biu,ski; anatomical sexology.

DISCUSSION.

Dr. Atkinson: I am in no proper condition to speak upon this subject, but sometimes the lack of preparation is the opportunity to say the best things. I am fully aware of the depth of the subject of terminology that was presented last night, and read so clearly and so patiently by my friend and co-laborer in that field, Stephen Pearl Andrews. I noticed a disposition of restlessness that I was sorry to see at this time in this body. This has occurred before when papers were being read in this Section; but we enjoy the satisfaction of each year having a few come up to better appreciation of this abstruse subject. The paper read last night is but a continuation of the three reports previously made before this body on terminology; and I was convinced from intimate association with Stephen Pearl Andrews that he had the key to this whole question of properly expressing the various degrees of mental activities, so as to exactly represent in sounds the affections of the mind.

The proposed lay-out is not yet complete, but those who have studied the former reports should have been able to follow last night; but each report is a little in advance, and is not quite comprehended. The disposition has been to resist it, and not candidly entertain it; when anything was said that they could not quite comprehend, it was scouted as if personal insult was offered, and that too when proffering them the rich treasures of intuition, attended by close study of an earnest mind. That is the way that it seemed to me. We saw last night how, for the lack of just such a means of pronunciation, brilliant men made dreadful blunders. What shall

we do? I beg patience and attention for one or two years more until this issue has been pronounced, until the case is fully before the court; and then when it comes up we will be able to demonstrate to you the reliability of what has been said. We will not be shoulder-strapped with mere memory of the dogmas that have stood in the way and made us differ. If we would inquire *how* we differ, and try to learn where each individual stands more than to ask *why* we differ, we would be better peacemakers, and we would be better fitted for the instruction of this body. I have not the time nor the disposition, nor you the preparation or patience to follow the depths of the paper that was presented to us, and I ask you one and all as you know me to be in earnest, not for myself, but for you and for all,—I ask you to patiently study this with former reports so that you may not come, as many of the lights in dentistry have come to my office after the Transactions had been out over a year, and given no evidence of their having even glanced over my former reports on this subject.

Dr. WATERS: I have heard these papers heretofore with a great deal of pleasure. It is a matter I have had some previous thought of. I started in an examination and investigation of that subject many years ago. I suppose Benn Pitman must have to some extent given me the first idea on that subject. S. P. Andrews, of this city, may, I suppose, be the father of it in its present form. At any rate I consider that man an inventor, a discoverer of that idea. He is just as much a discoverer and inventor as anyone, as the discoverer of a new machine, or a new instrument, or a new use for a new article. The thought that came to me as I listened to Dr. Atkinson, and as I looked around and saw how little interest was taken in what he was saying, was that he was not understood. There came to me the story of the boy who had been to Europe with his mother; she sent him to a German school; he was a little fellow, and when he came home, she says, "What did you learn?" He says, "Nothing." "What did the children say?" "They said, 'goloshes.'" "Nothing but that?" "Nothing; nothing but 'goloshes,' 'goloshes,' all the time." What were goloshes? Their rubber shoes; when they went in the shoes were taken off, and they put them in their places, and when they went out it was calling for goloshes, and when they came in it was take off goloshes, and he had that one word, and everything else was in a jumble of sound and seemed like goloshes. He was confused, and so it is with other people. When a new idea comes before them for the first time, unless that idea is repeated over and

over again (men are like children; they are children of a larger growth), the idea is not accepted because not understood. So it was with Dr. Atkinson's first paper, and so it was with his second paper. If I were going to start on that ground I should begin with the first breath, and I would say, what does it mean? It means the giving birth to a soul; a starting in life; the first breath. And so from the breath I would build up the human voice or speech, with the glorious ideas that come with it. Here is a man who has commenced the work and carried it up. If not all, some of that will be accepted by us if we live long enough. But there is a great deal of old fogyism in the land, and it takes a life-time to get a new idea in; and it takes a life-time to drive the old fogyism out, and the old fogyism must be started out first. Here you are all spelling from infancy, and spelling "though" which might be written t-h-o, or, if you knew how to write phonography, with two signs, th (giving the sound of th in thee) and o. We ought to have another letter that should be instead of t-h. You ought to have a sign for that sound, and the meaning of Dr. Atkinson's paper is just as great and just as clear to my mind as that t-h-o-u-g-h never should be taught in our schools as spelling "though." I cannot discuss his last paper because I did not hear half of it, but I can say this much, I hope the next time he gives a paper on this subject, he will give us a résumé of the points previously made in the first place—go over the whole ground—and that you will then be able to see there is something in it.

SECTION IV.

OPERATIVE DENTISTRY.

Cylinder Filling.

PAPER BY GEORGE J. FRIEDRICHS, OF THE SECTION.

IN these days of cheap dentistry and in the face of the "New Departure (which is synonymous with cheap dentistry and want of operative skill), I desire to call your attention to the method of cylinder filling with non-cohesive foil, brought before the profession by the late Dr. J. S. Clark, the author and inventor, at the first session of the American Dental Convention, held in Philadelphia in 1855.

In giving his invention to benefit mankind and his co-laborers in the field of dentistry, how was it received? I am sorry to say with indifference. In fact, if I have read the transactions correctly, it was "Nothing new under the sun," and so stated by some present at that convention, who stultified themselves by trying to describe their method of manipulating gold foil in the form of cylinders.

I am well aware that this is not the time nor place to teach dentistry; nevertheless, in bringing this subject before you, I am in a measure compelled to demonstrate—

1. The manner of preparing the cylinders (as those prepared by the manufacturers of foil are only in part practical.)

2. The instruments necessary with which to pack them.

3. The manner of introducing them in order to make an impervious and solid filling.

It stands to reason, if we fold a sheet of No. 4 foil upon itself we shall have the sheet one-half its original size and in the shape of a parallelogram. If this process is repeated five times we shall have a strip of foil thirty-two times the thickness of the original sheet, and so on; but as the number of layers increases, the flexibility of the mass decreases and it becomes less pliable. Therefore, in order to make small cylinders and yet leave them soft and pliant the sheet

must be cut into halves, thirds, and fourths. The smaller sizes of cylinders are not yet in the market, and those who use cylinders entirely in filling are compelled to prepare them themselves. Besides, applicable cylinders are yet to be prepared by the manufacturer of dental materials, for should I be compelled to rely upon those they now furnish I doubt very much (though I have practiced cylinder filling for the past thirty years) whether I could make a compact filling with them, and I have no doubt that this in a great measure is the reason why this method has not been more generally adopted by the profession.

The instruments necessary, and without which no cylinder filling can be made as taught by the inventor, are similar in shape to Nos. 19 and 20, designed by Dr. W. G. Redman, exhibited in Dr. Garretson's *System of Oral Surgery*, Fig. 102, page 324. To form a set of these, a dozen sizes at least are requisite—round-pointed, turned at an angle of about thirty-five degrees, slightly tapering from shank to point, and spring-tempered; the smallest in diameter to be about the thickness of a cambric needle, the next one a third larger, length from shank to point to increase with size, and so on.

The method of manipulating the cylinders is as follows: Choose the first one of as large a size as can be conveniently introduced into the cavity to be filled, the cylinder being of sufficient length to protrude somewhat above the orifice of the cavity, in order to have material for condensing when no more gold can be introduced. This first cylinder is then forced against the parietes of the cavity by introducing the largest size of the above-mentioned instrument that the cavity and cylinder will admit of, when space will be found made for the introduction of the second cylinder. When the cavity is full, although not densely packed, one of the small-sized instruments aforesaid is then forced in between the cylinders; this opening is then enlarged by the next one in size, repeating this process—being governed in this procedure by your judgment as to how much lateral pressure the tooth you are filling will stand, as if this pressure is carried too far there is danger of splitting the tooth. Filling this space with an appropriate cylinder the process is to be repeated, care being taken that none of the cylinders choke, but go clear to the bottom, until the filling is completed and packed as solidly by lateral pressure as the strength of the tooth will admit of. After which the surface should be condensed, dressed down, and polished.

With an ideal filling are associated certain requisite conditions:

Firstly—The material employed must be, to all intents and purposes, indestructible in the oral cavity. Secondly—It must be packed sufficiently solid, so as to render it impermeable to the fluids and other substances with which it may be brought in contact. Thirdly—It must be flush with the orifice of the cavity and finished in such a manner that it can be kept clean.

Now, by this method of using cylinders, can we arrive at or approximate making an ideal filling?

I will give you the points of excellence and leave you to draw your own conclusions:

1. A sheet of foil is still a plate of metal retaining its due share of tenacity. When the sheet is folded the tenacity increases; therefore, when a cylinder of gold foil is placed in a cavity in a tooth, you have a laminated mass of gold that reaches from the bottom to the surface. Consequently a cylinder filling never comes out by piece-meal; it either comes out *en masse* or else it stays where it has been put.

2. Lateral pressure being brought to bear on the gold while still soft from the commencement and continued to the end of the operation, a perfect adaptation to the parietes of the cavity must ensue.

3. When a tooth is strong enough to bear the pressure, a solid and impermeable filling can be put in by lateral pressure alone, which is a desirable item in difficultly located cavities—such, for instance, as proximal cavities between the bicuspids and the molars.

4. No retaining-points are requisite to keep the gold *in situ*.

5. Rubber dam may be entirely dispensed with, and no matrices are required in filling proximal cavities; for, if you let your cylinders protrude sufficiently beyond the orifice of the cavity, they can be finished up to give the desired fullness.

6. Submarine fillings can be made with them.

7. By this method an impervious filling can be made with more certainty in less time and with less labor than by any other mode practiced up to the present time. For, after a cavity is prepared and ready for the gold, it can be filled by this method, provided the cylinders are ready-made, in ten minutes, * whether the cavity is large

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* Dr. Bogue brought this subject up before the New York Odontological Society (*vide Dental Cosmos*, Vol. xxiii., No. 2, page 87.) In the discussion he relates: "When Dr. Atkinson introduced heavy gold for our use, like all the rest of us, I experimented some. I took a steel plate one day, making up my mind to put

or small, whether it is situated on the grinding surface or in a posterior proximal cavity of a molar; that is, your gold is packed ready for surface-condensing and finishing in the time above specified.

I read or heard the remark made that cylinder fillings are excellent in simple plain cavities. Well, I am willing to forgive that man, for he evidently did not know what he was talking about. But in one sense he was right, for what are truly difficult cavities to fill by other methods, really become, when cylinders are employed, simple ones. There is only one thing that cannot be accomplished with cylinders, and that is, an artificial crown cannot be built up with them; but aside from this, whatever can be done with gold in the mouth for the preservation of the teeth, can be effected with cylinders.

Crystal gold and cohesive foil were a god-send to thousands in our profession, for they enabled many—and do yet—to put some kind of a gold filling in that will stick for awhile. When failures followed, it was then found out that only those met with success who took sufficient time, and packed their gold in small quantities against the parietes of the cavity as they progressed; for they well knew, if a perfect adaptation was not attained at this point of the operation, no amount of pressure or malleting would adapt the gold to the walls of the cavity ever afterwards; for when the packing was once completed, they had a coherent mass of gold which had more of a tendency under pressure or malleting to contract upon itself than to spread.

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in as good a plug as I knew how. I put that filling in in one hour and ten minutes. A few weeks later, while talking with Dr. Moffatt, I asked if he ever used cylinders. He said 'No.' I then showed him this experimental filling that took me an hour and ten minutes to insert with cohesive gold, and said: 'The same steel plate lies here. I will see what I can do with cylinders.' The cylinders were ready-made. Just as I made that statement, the church bell rang. I filled that cavity in twelve minutes, filed it off and burnished it—the same identical hole in the steel plate that it took me an hour and ten minutes to fill with heavy gold. The plug was driven out afterwards. I think I have it yet. It is coherent, and the gold was supposed to be non-cohesive gold."

Dr. BROCKWAY: "How did it compare with the other filling?"

Dr. BOGUE: "It was far more perfect and better adapted to the walls than the first was, but it was soft. Our friend, Dr. Latimer, poked it with a lead-pencil and made a dent, and I suggested that if it was in a tooth it would not be poked with a lead-pencil, and would not be liable to be destroyed in that way. Every little imperfection—marks of the instrument with which the hole was bored—was seen in the softer filling."

Therefore, my conclusion is that a filling made of cohesive gold is either a good or a very poor one. The difference between it and a cylinder filling is, the former remains in contact with the parietes of the cavity from mere adaptation, while the lattter not only remains in contact from adaptation but, from the mode of introduction, is held there by the tension of lateral pressure also.

The only true method by which a root-filling can be made with any certainty, is on the principle of cylinder filling; for, the gold rolled in a cone—the shape of the pulp-canal—becomes, in part, the instrument by which the object is accomplished. In looking over the methods given by different authors for root-filling, I could not help smiling to see the array of nerve-canal pluggers, represented as necessary to perform this operation; when the very object can be accomplished with a foil-carrier, a piece of untempered steel the thickness of a darning-needle, about an inch and a half long, tapering down to a point, the shape and size of the pulp-canal, and a pair of flat-nosed pliers.

The modus operandi is: With the foil-carriers, introduce the first cone into the canal, care being taken not to force it through the foramen at the apex of the root; then take up the above-mentioned steel instrument and push it up beside the gold cone. When forced as far as you can with your fingers, grasp it with the pliers, forcing it into the canal as far as it can be made to penetrate. Withdrawing the instrument gives room for the introduction of the second cone. Repeating this until no more can be packed into the root-canal completes the operation. The cones are prepared by taking a strip of foil and rolling them on a common watchmaker's broach.

In conclusion, let us look at this question from another standpoint. The value of gold as a material is, comparatively speaking, of no consequence in the filling of the teeth. It is the skilled labor and the time required that are the valuable factors in the case. Therefore, if a sufficient number of fillings can be put in by whatsoever method, even at moderate charges, a fair remuneration for the skilled labor employed is obtained; while if it takes three hours to insert one filling, the fee exacted must be in proportion to the time and labor expended. Hence the cry by a certain class of the profession for a cheaper material, on the plea that this style of work places the services of the dentist out of the reach of the majority of the people. Then again, how can you reconcile your consciences to the fact that in packing and malleting for hours, you are making your patient suffer the torments of the damned, while your prede-

cessors in dentistry accomplished the same results without entailing one-fourth the suffering. What are the consequences that follow? Gutta-percha, oxychlorides, and amalgam are invoked, and these are placed on a par with a material that has stood the test of time. Now, Gentlemen, is not this a picture of the true inwardness of where the profession stands at the present day?

SECTION IV.—Discussions.

Root-Filling.

Dr. Atkinson: Whenever a tooth is removed from the human body, and is in connection with any portion of living tissue through which protoplasm circulates (wherever the containing chamber is), it will be filled with protoplasm. And if it meets with a ferment, it will go into decomposition or be encysted. If the poison or ferment be weak, it will be limited, and the root will be encysted and be useful. If the infection be virulent in quality or considerable in quantity, retrograde metamorphosis will ensue, limited by treatment or constitutional vigor. That is the great point in the case. I studied this closely, and became convinced that it made no difference what you filled the root with if you only hermetically sealed it. It made little difference whether it was full from the point of the root to the pulp-chamber if it had been disinfected. My present idea is this: that the best filling for the root of the tooth is oxyphosphate of zinc. Any substance that is plastic enough to entirely exclude all the protoplasm is sufficient. Should abscess be threatened, all you have to do is to make a very simple operation. Take a bit of cotton wet in chloroform to obtund the sensibility, and with a sharp lancet go through the gums and the alveolar process to the end of the root, and down to the cement. You need not even dress it. Just let it alone quietly. In ninety-nine cases out of a hundred you will succeed. The point is this, that through ignorance dentists over-treat nine-tenths of the cases they have in their hands.

Dr. Wetherbee: There is a great diversity of opinion with reference to the best method of filling pulp-cavities. There are those

who believe that gold is a most excellent material, and that in a majority of cases it may be carried to the foramen, preventing the possibility of the formation of gases in the pulp-cavity. Others believe in the use of gutta-percha dissolved in chloroform, claiming that it can be forced to the foramen without difficulty. Again, some practitioners believe in filling pulp-canals with oxychloride or oxyphosphate of zinc, as these can be more easily and surely forced to the end of the canal, claiming advantage over other materials in their antiseptic character.

Of the latter class is my highly-esteemed and eloquent friend who has just taken his seat. I take issue with him with reference to filling pulp-canals with oxychloride or materials of like character. In the first place you cannot be certain that you have carried the oxychloride or oxyphosphate to the foramen. In the second place, if you shall have done so, and the cavity is absolutely filled, and it shall have hardened, how long will it remain in that condition?

I have had occasion to treat very many teeth whose pulp-canals had been filled supposedly well or perfectly with oxychloride (not by myself, as I never use it). In those cases without an exception I found disintegration of the material to a greater or less extent to have supervened. It may be suggested that these failures were due to imperfect manipulation, or to the poor quality of the material used. But the fact is, oxychloride, as also the oxyphosphate, of zinc is an absorbent. They take up the moisture from the dentine, and become disintegrated in the course of time; when thus disintegrated the generation of mephitic gas may follow, and pericementitis will usually supervene.

I had a case in point to treat one year ago last winter. It was the right superior central incisor, filled by a gentleman who is a positive friend to oxychloride. Three years previous to this time, he had supposedly well filled the pulp-canal with oxychloride. After the lapse of three years, an opening was made through the palatal surface to the pulp-canal; through the oxychloride I carried a broach to the end of the root. This operator considers himself an expert in this line of practice. So much for oxychloride, whose integrity is of such doubtful character.

The above results may not obtain in the use of gutta-percha; but where there is room to use this material, there is generally room for the skillful hand to use gold, and the latter is always to be preferred. But I am met at once with the declaration that gold is more expensive, as it requires more time. Alas! who of us are to

count time when the best interests of our patients are involved? I have very little difficulty in filling pulp-canals in incisors, cuspids, and bicuspids. I believe that where you may carry oxychloride, or gutta-percha dissolved in chloroform, you may also with labor and care carry gold. It is claimed that oxychloride and gutta-percha are therapeutically better for the root than gold. I deny it, and demand the proof.

Dr. ATKINSON: I appeal to the house if in my remarks I said "oxychloride" at all. I said "oxyphosphate." The idea of jumping at the conclusion is preposterous and unsafe. All of you who know anything about it know that oxyphosphate will set, if mixed intelligently, under saliva or water, and will *harden* so as to fill the chamber perfectly. The statement as to no oxychloride of zinc being impervious to the fluids of the mouth, does not amount to anything. We all knew that long ago. I am talking about oxyphosphate. If they know anything they know enough to go beyond the end of the root without incurring danger, if they do not carry a ferment from a dirty instrument—look out if you do that! Do it with your whole soul, and you will succeed in every instance. No use of talking "nine times out of ten;" you will have success in every case. Nature never lies. When you are certain it is nice and tight, fill the whole chamber up, and build on the crown of the tooth at the same time, and I think that is enough on this point. The great difficulty is that they were positively afraid to go through to the end of the root of the tooth. By the use of the oxyphosphate for filling pulp-canals, you can save all the labor necessary when gold is used, and secure a filling that is more complete than any man can make with gold in the canals. It is worth your attention to follow what I have said in filling with oxyphosphate, which is better than any oxychloride that I have ever seen, except the old make. I have seen that in the teeth without wasting for fifteen years and just as flush as I could wish it to be. When we fill with oxychloride or oxyphosphate we should leave shell enough to put a gold cap over and make that impervious. You get this advantage: That the conduction or conductivity of either oxychloride or oxyphosphate is so nearly allied to the tooth-substance, that the patient receives no shock, the thermal current being cut off by the depth of this non-conductor.

Dr. MCKELLOPS: For the last seven or eight years I have been giving special attention to the subject of the best material for filling root-canals; and I have tried our distinguished friend's method of

introducing oxychloride or oxyphosphate of zinc with cotton, but with my best endeavors have found it impossible to perfectly fill such canals. But wherever I can get the point of a broach, say the finest Stubs's steel broach made, I can, by the use of gutta-percha dissolved in chloroform, fill such canals perfectly. The operation in case of the anterior roots of the lower molars, or the buccal roots of the upper molars, requires a great deal of work and a great deal of care and patience. But if a man only has patience and perseverance, and loves his profession, he can accomplish every time the best results, even in the smallest and most crooked canals. A gentleman says it takes a long time to fill such canals with gold. It does not take one-tenth part of the time to fill them with dissolved gutta-percha because gold cannot be got into these canals to fill them perfectly. There never was a man that did it. In the use of gutta-percha there need be no fear of its setting, because if it becomes too hard by the too rapid evaporation of the chloroform you have only to use a little more chloroform and it will immediately soften again; and after the root is partly filled with the dissolved gutta-percha, and the latter is still soft, take a piece of gutta-percha that has not been dissolved, cutting it so as to approximately fit the canal, and after warming it, by pressing it up into the canal, you can force the soft material quite to the apex of the root, and even beyond it. The patient will give you an indication of its reaching that point, as it will frequently cause a slight pain. If you will remember, I brought this matter up two years or more ago at Niagara Falls, and I have been steadily using this method ever since, and have yet to see the first case that I have lost. I have had periostitis occur and last for a week, but with a little treatment and a little encouragement to the patient, that has gradually passed off. There are other gentlemen present who have tried this method, but I wish to say to the profession generally, all I ask is for them to give this method a fair and square trial, and if they will do so, I will guarantee that there is not a man who will afterwards try to use gold unless in a perfectly straight canal.

Dr. Barrett: With gold it is utterly impossible to fill very small or tortuous canals; with oxychloride and oxyphosphate of zinc it is more feasible, but by no means easy. They stick and clog and so soon as crystallization commences that is the end of the operation. To properly fill a nerve-canal sometimes requires considerable time, and this neither of the two fillings mentioned will afford. It frequently requires half an hour, and you know that for such operations

they are utterly unsuited. When they have once commenced granulating there is no method by which they may be again rendered fluid. To my apprehension there is but one thing that fully fills the bill and that is gutta-percha dissolved in chloroform as recommended by Dr. McKellops. I have now used it for a number of years with constantly increasing satisfaction. With a Donaldson nerve bristle dipped in the solution I work and work the gutta-percha up to the very apex of the tooth. If the course of the canal be crooked or tortuous I wind a few hairs of cotton about my broach and using this as a piston I carefully force the gutta-percha onward—carefully, because if the foramen be open it is easy to force it through. Watch your patient and he will very quickly let you know when the canal is full. If the gutta-percha becomes too thick its consistence is easily changed by dipping the broach in chloroform or by simply warming it. The gutta-percha not only fills all the minute channels of the canal but in cases of loose histological structure it will penetrate to and fill all those little communicating chambers sometimes found in teeth of that character. I remember experimenting with one such recently removed tooth and after closing the apical foramen and then forcing the gutta-percha into the roots I found it exuding in exceedingly minute threads from a number of places upon the surface of the root. Upon subsequently cutting the tooth up I found numbers of these communicating chambers in the dentine and each completely filled with gutta-percha. With what other material could this result have been obtained? I believe, too, that it is more compatible with the tissues than is any metallic or irritant root-filling. Even when I have had good reason to suspect that some of the material had found its way through the foramen of the tooth I never knew it to cause any more than temporary mild disturbance. It is very soon absorbed or encysted and ceases to be a source of disturbance. But its successful use requires patience and experience. These having their perfect work I know of nothing that can take its place as a root-filling.

Dr. Brophy: At the last meeting of this Association Dr. Talbot called the attention of the members to a set of instruments he had invented for the purpose of straightening root-canals, and by the use of which the filling of roots is made extremely easy. If, however, the root be very tortuous, it is of course more difficult, and in some instances impossible to ream it out to the apex; but even if this cannot be done it is an advantage to enlarge the portion nearest the pulp-chamber, so as to make the introduction of the filling more

easy. The point of the instrument will not cut; it however follows the canal, and the sharp edges cut or chip off the walls of the canal, enlarging and straightening it. The root may be filled with gold, but I prefer and consequently use oxychloride of zinc, which I believe to be the best material in use for this purpose. Oxychloride of zinc adheres to the walls of the canal, hence it effectually excludes moisture. It is both antiseptic and disinfectant in its action, therefore any remaining mephitic gases in the canal are neutralized and rendered harmless. Oxychloride of zinc is easily manipulated when properly mixed, and a tooth whose roots and pulp-chamber are filled with it cannot become dissolved.

It has been said that oxychloride of zinc sets or hardens too quickly to enable the operator to manipulate it satisfactorily. If water, one part, be added to chloride of zinc, two parts (I speak of the liquid zinc chloride which accompanies the zinc oxide prepared and sold for dentists' use), no difficulties can be experienced in using it, as the hardening of the cement is retarded sufficiently long to permit the operator to thoroughly finish any root-filling.

Dr. McKellops: What is the use of using this Talbot instrument, incurring the danger of breaking its fine steel point in the root, or of cutting through the sides of flat or curved roots, when by the use of gutta-percha these dangers may be avoided.

Dr. Brophy: The object in using these instruments is to enlarge the canal so that the operator can see what he is doing, enabling him to as intelligently insert a filling in the root of a tooth as in its crown. Besides, in cases where the pulps of teeth have been dead for some time the canals fill with débris, which prevents the insertion of a nerve broach or any root-filling until after this débris has been removed; and this instrument is the only one with which I am acquainted that will remove the contents of the canal *without incurring the danger of cutting through its walls.* There is an objection to the use of gutta-percha. Evaporation of the chloroform may leave a space between the filling and the wall of the canal; the space will fill with moisture, and the object of the root-filling will be defeated. I do not state this as a fact, but I believe it is quite possible.

I have used these canal reamers since the first one was constructed, and I have to say I regard them as indispensable. If the instruments are properly tempered and used they are not likely to break.

Dr. Waters: I should like to say a word or two, and I do it because I think it a good plan to talk over difficult cases. I would not get up to say how I should do an easy thing. A case occurs to

me that is very difficult. It is where the growing teeth of young boys and girls have been injured, the roots of which are not fully formed, and the opening at the apices is quite large; what are you going to do in such cases?

I had a patient only ten years of age who came with both superior central incisors injured, one broken transversely and the other diagonally across the face, exposing the pulp in both cases. In one case a horn of the pulp protruded one-eighth of an inch, bleeding freely at the surface in contact with the edge of the opening to the pulp-chamber. With much difficulty I succeeded in arresting the bleeding of the pulp, and securing it from contact with the tongue and fluids of the mouth, by building over it a covering of oxyphosphate of zinc; that remained serviceable for less than twenty-four hours, when it came off, and the pulp, bleeding less, was again covered with the same preparation; this served its purpose longer, but in four weeks I had re-covered this pulp six times. At each succeeding operation there was an improved condition, and when last operated upon there was no exposure of the pulp—nature had protected it by a covering of new dentine. The tooth broken transversely across showed along the fractured surface four minute openings into the pulp-chamber, through which there exuded a colorless fluid. I supposed that I should have no difficulty in saving this pulp. The exudations were removed with bibulous paper, but not examined microscopically, and after the application of a three per cent. solution of carbolic acid, seemed to be arrested so that I succeeded in getting a good dry surface for the phosphate of zinc, with which I covered the end of the tooth. It seemed to be doing well for a few days, and then the pericementum began to inflame; on the eleventh day from first seeing the case I removed the phosphate of zinc cap and found the pulp to be decomposing. I cut away the dentine between the openings so as to get an elongated oval entrance to the pulp-chamber through which, with a nerve or pulp-hook, I drew the pulp entire, with a small rounded sac of pus attached to its superior extremity. No bleeding followed, and after washing with tepid water and a saturated aqueous solution of carbolic acid, (six per cent.) I proceeded to put in a permanent filling by first finding the depth or length of the dental canal by a hook made on a No. 25 (wire gauge) gold wire, which I passed into the dental canal, and hooking it upon the upper edge of the root marked on the wire the point of intersection with the fractured edge of the canal. I then folded a sheet of No. 4 gold foil into a square mat, the sides

of which were equal to the longest diameter of the opening into the dental canal. Having taken the wire from the canal I passed it through a small opening made in the center of the gold-foil mat, then folded the mat down upon the wire. I then, after drying the canal, passed the mat, preceded by the hook, into it, and bending to a right angle the wire at the point of intersection which I had previously marked, allowed it to rest against the edge of the tooth; this brought the hook into the center of the dental canal and at the upper end of it. I now passed up a small root gold-packing instrument, and with care opened the mat against the hook on one side, and to nearly the same extent upon the other, taking care that the corners of the mat were not forced up and out of the canal. Having the mat thus fixed in position it was an easy matter to fill the canal below it with zinc phosphate. The gold wire was cut off at a convenient distance, and the tooth built down with the phosphate. The periosteal inflammation subsided at once, and the tooth has since been in a serviceable condition. The operation was in March, 1880.

Dr. MILLS: This matter has been gone over elaborately, and it seems to be a rehash of the same thing from year to year. All who listened to Dr. Atkinson, and listened to the paper of Dr. Friedrichs describing root-filling, will have to take this fact into consideration, that there is a modicum of good in all these ways, however much men may differ. Take Dr. Wetherbee's method of filling root-canals; his is a dogmatic style of stating things. He is capable of doing things other men cannot do. Every man has not the indomitable will he has. Dr. Atkinson demonstrates what should be a *principle* of practice *as a rule*. Every man *must* admit that there are exceptions to all rules, and all of us know that in filling roots we encounter more or less difficulty in the operation. These difficulties we must devise ways and means to overcome. The man behind the instrument is the one that makes the operation, and it depends upon the power that lies in him. I can explain my methods, but the question is whether another man can carry them out. I wish to say this for the sake of men who have not had as much experience as myself. The time is coming when we will be proved men, and strong men, and let us thank God and take courage. This applies to dentists in general, so what we get here let us carry home with us, and so far as our judgment and possibilities will permit, put it into practice, and prove or disprove it.

Dr. LITCH: There is good in all the views presented to us on this subject. It is as well to take it up where the discussion was left

off, and with your permission I will endeavor to replace upon the board Dr. Atkinson's diagram. I think he made a shoulder at this point, his idea being to open the pulp-canal to its fullest extent. If I understand Dr. Atkinson's practice, this must represent a tooth in which the pulp has undergone devitalization and subsequent putrefaction before coming under his care, as Dr. Atkinson does not devitalize pulps, I believe.

Dr. ATKINSON: Never; not at all.

Dr. LITCH: From this stand-point, regarding the tooth as in a putrescent condition, Dr. Atkinson's practice seems to me to have many points of excellence, although I cannot fully indorse the great enlargement of the apical foramen which he seems to recommend, unless it becomes necessary in the treatment of alveolar fistula. A tooth containing a putrescent pulp, or its remains, or the pulp-chamber of which has long served as a place of lodgment for oral fluids or secretions or for food-fragments, is essentially a tooth saturated with putrescent matter. It is not only present in the canal proper, but it permeates the tooth-structure, filling the tubuli with gas-generating fluids. Dr. Atkinson's free removal of tooth-substance necessary to effect the great enlargement of the pulp-canal here represented, necessarily limits the zone of putrescent tissue. I say zone, because we can hardly regard the relatively highly organized matter of the cementum as either putrescent in itself or tolerating to any extent the immediate presence of putrescent fluids. The conditions of life and death are antagonistic; they cannot coexist. Unless the tooth has undergone complete necrosis there must be a point where death ends and life begins. Dr. Atkinson's method would seem to remove by mechanical means nearly the whole mass of putrescent tissue in the tooth. It of course weakens the tooth; but it is of itself antiseptic treatment of the most radical kind. Moreover, this great enlargement of the pulp-canal renders the application of sufficient quantities of such antiseptic agents as are usually employed in dentistry much more easy, and, at the same time, as we have seen, greatly reduces the extent of putrescent tissue to be acted upon. The zinc phosphate preparations recommended by Dr. Atkinson are themselves antiseptic, a fact which certainly commends their use in this class of cases, although this antiseptic power is necessarily of limited duration, as is the case with all other antiseptics known to surgery. With a greatly enlarged pulp-canal the zinc phosphate preparations can be readily introduced, and of such a degree of consistence as to make a reliable and per-

manent stopping. With a very contracted pulp-canal this is hardly possible.

And just here come the limitations which render the radical procedure recommended by Dr. Atkinson impossible in a very large class of cases; such cases, for example, as the anterior root of a lower molar, or the buccal roots of an upper molar, or the extremely compressed root of a bicuspid tooth, in which the pulp-canal is merely capillary in its proportions, and the pulp itself the finest filament. Clearly, such an enlargement as is here represented is impossible without perforation of the lateral walls of the root. In other cases, while the caliber of the root would permit of the enlargement of the canal, the position of the tooth in the mouth is such that it is impossible to bring a drill to bear in the line of direction necessary to safely effect such enlargement, without destroying an entirely inadmissible amount of the crown of the tooth. These are, however, but limitations upon the execution of what is, in the main, and within due lines of discretion, a good plan. It is well always, where practicable, to enlarge the pulp-canals of putrescent teeth to a reasonable extent, in order to facilitate and expedite the antiseptic treatment, and render the introduction of an impermeable stopping more easy. I am satisfied that very many cases of failure in the treatment of putrescent teeth arise from a neglect of these minute pulp-canals; small as they are they contain putrefactive matter, and are surrounded by a putrefactive zone, and it is exceedingly difficult, if not impossible, to act upon such a canal and root from base to apex by the absorption, vertically, of either carbolic acid or creasote. The tissues are dense, and the line of direction is at right angles with the course of the dentinal tubuli, thus necessitating that the antiseptic agent shall penetrate the walls of each tubulus in turn before the apex can be reached. From such cases, thus treated, alveolar abscess is pretty sure, sooner or later, to result.

These capillary canals, however, are not such obstacles to success when the pulp is devitalized, and the bulk of it immediately removed, and the canal at once filled, because, although filamentous portions of the pulp may remain, they do not undergo putrefaction, atmospheric air being excluded, but are usually absorbed. Never in an experience of ten years have they caused trouble; never during that time have I had an alveolar abscess in a tooth the pulp of which I have myself devitalized and removed, the subsequent stopping of the canal being of course understood.

As a stopping agent in such cases I have always used and still

continue to use the gutta-percha preparations, heating them and packing into the canal with heated instruments. These preparations I find more generally and readily applicable than any others, and I believe that they accomplish all that is necessary in the process as well or better than any other agent; that is, the thorough sealing of the pulp-canal against the invasion of animal fluids from any source. I cannot conceive that gold foil at its best can do more than this, or do it as well. I should as soon think of stopping a bottle with a wad of gold foil as a root-canal. Under all ordinary circumstances the one would be about as rational a procedure as the other.

During this discussion a solution of gutta-percha in chloroform has been recommended as a root stopping, and the claim has been made that it can be forced into the most minute capillaries, effectually sealing them. A great deal can of course be accomplished by practice; but I am a little doubtful of my ability to take a minute portion of gutta-percha solution upon a fine broach and force it against gravity up to the apical foramen of the fine pulp-canal of say the buccal root of an upper molar. It is not so easy to do this with any fluid, much less so adhesive a fluid as gutta-percha solution. Moreover, supposing the canal to be filled with the solution, I should hardly expect to find it fully filled with the gutta-percha after the solvent, the chloroform, had evaporated or undergone absorption. Certainly the chloroform must represent some space, and unoccupied space means to that extent an imperfect stopping. Another danger I should apprehend in the more permeable class of pulp-canals would be the forcing of a minute portion of the solution through the apical foramen. This would be certain to result in inflammation. One of the gentlemen who have advocated this method alluded to this possible complication, but stated that the inflammation resulting was not usually of a high grade. As I have, however, twice seen a very violent inflammation of the root-membranes result from a similar accident with carbolic acid I am a little doubtful upon this point. Carbolic acid would of course be more certain to produce this result, but if any gentleman doubts the highly irritant effect of chloroform when shut up in contact with animal tissue without opportunity for evaporation, he need only try its vesicant powers, under such conditions, upon any portion of his dermal structure he may see proper to submit to the experiment.

Dr. Niles: There is just one word I want to say about the nature of the filling-materials spoken of as used in filling pulp-canals. Dr.

Atkinson, I believe, made the statement that oxychloride disintegrated. I should like to ask the doctor why it disintegrated.

Dr. ATKINSON: I did not make that statement. It was made by Dr. Wetherbee.

Dr. NILES: I will direct the same question to Dr. Wetherbee.

Dr. WETHERBEE: From two causes, one of which is always present, viz.: the absorption of moisture from the dentine. In the second place, from moisture percolating through the foramen.

Dr. NILES: If oxychlorides are dissolved by the absorption of moisture, phosphates are liable to the same objection when mixed to the consistence of cream, as I believe Dr. Atkinson said he used them. Oxyphosphate when mixed to the consistence of cream forms a product which is soluble in water. That can be demonstrated by any one; and in my opinion that would be an objection to its use in the canal of a tooth. It is very evident that some moisture must come down from the tissue at the end of the root, especially if the opening at the apex of the root has been enlarged. Thus the oxide of zinc and phosphoric acid would become decomposed, and would be useless there as a permanent stopping. The solution of gutta-percha I should think would be more acceptable, from the fact that after the evaporation or absorption of the chloroform, the gutta-percha is insoluble in any fluids that could reach it. The objection which was spoken of by the last speaker is hardly tenable, for in the upper molars the solution would be drawn up by capillary attraction. The canals are very fine in most cases, and the solution is very easily drawn to the apex of the root by this force.

Dr. MERIAM: We have heard a good deal of root-filling, and the gentlemen seem to "pick their cases"—those with straight roots, incisors, etc. In practice patients are not so kind, but often have molars with roots so curved that a straight line cannot be drawn from the pulp-chamber to the apex. I do not see how we are to drill to the apex of such roots, following the pulp-canal, or enlarge it to this point with the Talbot reamer as has been recommended. But what I wanted to speak of especially was brought out by the reference made to the difficulty of using gutta-percha dissolved in chloroform, owing to the evaporation of the solvent. We have for some years used instead of chloroform the oil of cajeput. This with heat softens gutta-percha and has all the advantages of chloroform, and also gives all the time needed for manipulation.

Dr. WEBB: By opening directly through the crown of a molar tooth each pulp-chamber can be made accessible. Where death

of the pulp has just taken place, or in those cases where the tissue has not become putrescent, the apical foramen should be closed with gold as soon as the bleeding ceases; exudation of blood usually follows the rupture of the vessels at the end of the root by the removal of the pulp. Gold ought to be used for closing the foramen, for the reasons that narrow strips of light foil can be put in place with the certainty of having the air in the pulp-chamber pass out alongside of the piece of foil as it is carefully moved toward the end of the root; the accurate measurement of the length and diameter of the pulp-chamber (which measurement should be taken just before introducing the filling) can be more strictly observed in closing the foramen with foil than in the introduction of oxychloride of zinc or gutta-percha. When, also, foil is placed as near to the end of the root as possible without passing through the foramen, the gold (when carefully and solidly put in place) entirely prevents fluids from entering the pulp-chamber, and this is the most important point about, and almost the entire object in, filling roots. If the foramen be not properly closed, the filling of pulp-chambers cannot well be otherwise than unsatisfactory and the operation an almost useless one. Gold can be used in every case if the operator can reach the end of the root. When a small broach can be placed to the end of a root, even then the foramen can be closed with gold. The pulp-chamber should first be thoroughly cleansed and the foramen then closed with light gold foil, folded once upon itself, or made into three or four thicknesses, and cut into very narrow strips. Cotton is the next best material for the filling of roots. The cotton should be moistened with carbolic acid, and a few fibers at a time be then carefully placed in position at the foramen and be so solidly packed as to prevent infiltration of fluids from the end of the root. Cotton alone can be got to the foramen easier than that which is saturated with oxychloride of zinc, because there is then no oxide of zinc to clog the way.

Dr. SHUMWAY: What objection have you to tin?

Dr. WEBB: Tin does not work so nicely as gold foil, and its oxidation is objectionable, especially when placed near soft tissue. One of the reasons for the use of tin as a filling-material is that, where it is not so placed against enamel or dentine as to entirely exclude moisture, the oxidation of the metal fills up the space between the tissue and metal to some extent, and retards, though it does not prevent, further decay. It is far better to make each filling moisture-tight.

It is sometimes necessary to take a fine drill and carefully enlarge the pulp-chamber, but it is better to fill to the end of the root without the drilling. Then, and not till then, the remainder of the pulp-chamber may be filled with oxychloride of zinc, instead of gold, where the operator can be sure to get this material to the gold at the end of the root and get the air out at the same time. The foramen being closed with gold, the oxychloride of zinc cannot pass through to the end of the root any more than fluids can thus enter the pulp-chamber. It is well to use oxychloride of zinc in this manner, instead of gold, in some cases (as in those where the pulp has remained dead in its chamber for some time, and where abscess has taken place), for the reason that the chloride of zinc coagulates the protoplasm and prevents or arrests the decomposition of the ends of the fibers of living matter in the dentinal canaliculi. The foramen ought to be closed with gold before filling with gutta-percha, even when the pulp-chamber is to be filled in the thorough manner described by Dr. McKellops. In closing the foramen each narrow strip of gold foil should be taken on the end of a suitable packing instrument and placed near the end of the root and tapped carefully with a light hand-mallet till the feel and the sound of the instrument indicate that the gold is placed solidly in position. There is less liability of getting gold through the foramen against or into the tissues outside the end of the root by tapping the instrument with a mallet than by placing the foil in position by hand-pressure.

In the treatment of pulpless teeth, and especially those wherein the pulp has been dead for some time and abscess is in its incipiency, or where it has gone on to such an extent as to prevent rebuilding of the tissues surrounding the end of the root, it is sometimes necessary to carry a small drill just through the foramen so as to make a fresh wound and secure healing by "first intention" without inflammation or suppurative action. Japanese bibulous paper, carefully wound around a broach of suitable size, should be used for drying out the pulp-chamber and applying remedial agents. Liquid weeping through the apical foramen should be examined with a magnifying glass, and if the parts of the paper can be clearly seen through the fluid, such fluid is protoplasm from the elements of the tissues about the end of the root. A little deliquesced chloride of zinc ought then to be carried to, but not beyond, the end of the root to coagulate the protoplasm, when the foramen should be closed at once with gold, and the entire opera-

tion may then be completed. If the surface of the paper on the broach cannot be so clearly seen through the fluid after withdrawing it from a pulp-chamber, pus may be looked for and further treatment be required.

In cases where the foramen is so large that it cannot, without great difficulty, be closed with foil, then a gold wire should be fitted accurately by measurement in the end of the root and be carefully put and held in position with oxychloride of zinc; after which the whole pulp-chamber should be filled with the cement. After closing the foramen in each of the roots of molars and filling the greater part or the whole of each pulp-chamber with gold, it is best to fill the bulbous portion of the chamber and a part of the cavity of decay with oxychloride or oxyphosphate of zinc. When this material has hardened, sufficient anchorage ought to be made and the operation completed with gold. When it is necessary to use the pulp-chamber for anchorage, as in cases where a large portion of or the entire crown is to be restored with gold, each pulp-chamber should be filled entirely with cohesive foil, made solid throughout by the proper use (not the abuse) of the mallet. In most cases the gold in a pulp-chamber can thus be made as strong as, and, to serve the purpose intended, better than, a gold wire.

Dr. Shumway: In regard to moisture in the root a little alcohol will dry that all away almost instantly.

It seems to me that the gentleman from St. Louis has said about all there is to be said in regard to root-fillings—in regard to following the canal in the root of a tooth. Nature has made the opening, and it only remains for the dentist to close it if the nerve has ceased to perform its functions. If the canal cannot be reached without enlarging it, then there is no necessity for filling it at all.

I would allow no dentist to drill a hole through the root of a tooth of mine, and I would not do to a patient what I am not willing to have done to myself. An incision from the outside will accomplish all that can be obtained by drilling, and it is perfectly safe. If you drill up through, and then force anything into, the opening, it becomes a foreign body just as much as though it was a sliver of wood in your hand. Nature has got to expel it before there can be a cure. There is no doubt about that.

Dr. Crouse: Suppose you treat the root of an upper bicuspid which is bifurcated, and the palatal root has a sac on its end, and there is no fistulous opening?

Dr. SHUMWAY: I should make the opening from the outside through the alveolus above the root.

Dr. CROUSE: Would you not force something through then?

Dr. SHUMWAY: I should make an opening large enough to allow it to discharge its contents. I should not enlarge the opening through the root.

Now, about cylinder fillings: I wish to say I am opposed to the mallet for filling teeth to avert decay. If a tooth is broken off or worn down, perhaps the mallet would not be an objectionable instrument to use to restore it. But this is something entirely different from filling teeth to avert decay. I object to the mallet because I believe the use of it is contrary to recognized natural law. The recuperative process must come from within the tooth. The filling must correspond or be compatible with this process. You strike a tooth with a hammer and nature rebels. If an oculist should say to a patient, your eye is diseased, I will take a mallet and fix it, he would exhibit about as much nerve as the dentist who hammers a tooth because it is decayed. A diseased condition is the same, no matter whether it appears in a tooth or in any other part of the human organism. The process of dissolution is the same in nature everywhere. The treatment for a cure must be based upon the same general law. Cylinder fillings are made up of laminæ or scales. The lamina is adapted to the walls of the cavity, and allows the recuperative process to go on in the tooth. It gives nature a chance to protect itself. Not so with the mallet; when you strike the gold with a hammer its tendency is to crystallize and contract rather than expand, and it becomes illy adapted to its position. It is a direct violation of the law of correspondence.

Dr. BECK: About eighteen months ago I had a patient, a young man of good physique, with no vices (a condition favorable for a happy result), who presented himself with a superior left lateral incisor having a devitalized pulp, and a filling in the lingual portion of it. Upon examination it was evident that there was an abscess at the apex of the root. The filling was removed, the pulp-chamber opened, and a free access to the root-canal obtained; with a Gates drill I followed the canal, and before I was aware of it, the instrument passed out through the end of the root; a copious flow of pus followed its withdrawal. A probe found the edges of the opening rough and irregular. I made the root-canal still larger in order to remove the roughened edges at the end of the root. Then I injected a solution of equal parts of carbolic acid and water; this was done every

other day for one week with no effect; a ten-grain solution of chloride of zinc also produced no result. I then used wood creasote, and after three applications pus ceased to discharge. The case was under treatment six weeks in all.

Dr. CROUSE: How many times a day?

Dr. BECK: Every other day. As the parts seemed to heal nicely, I packed the root-canal solidly with carbolized cotton, being careful not to let it project out of the end of the root. I then filled the pulp-cavity in the body of the tooth, and the cavity proper with gutta-percha. It has been eighteen months since the tooth was filled, and it remains comfortable and in good condition. There is no discoloration. There are many cases where gold cannot be used satisfactorily as a root-filling.

The rolling of gold rope-like and cutting it into pellets was taught me by my preceptor, Dr. J. D. White, of Philadelphia, twenty years ago. The comparison between the tooth and the eye made by the gentleman from Plymouth is simply absurd. As for the mallet, I have used the electro-magnetic mallet since its first introduction, and would sooner part with any other instrument than with it.

Dr. BARKER: I am in the habit of putting in cylinder fillings. The method of using cylinders is well illustrated by placing cigars in a tumbler, crowding them in at the center, and pressing towards the periphery. The cylinders should be made smaller and smaller, as you approach completion, and the last one used will be very small, and cannot be rolled too hard. After getting in all the cylinders possible, the whole should be condensed with a burnisher and finished in the ordinary way.

Dr. LAROCHE: The cylinders you see made here by Dr. Shumway are not properly cylinders. They are shoved together and are what I should call pellets.

The method of making cylinders taught me by Dr. John S. Clark, of New Orleans, in 1854, consists in rolling soft gold foil (No. 4) around a small watch-broach. For No. 0, lay two sheets together; for No. 1, use only one sheet, and for No. 3, one-third of a sheet; these should be folded in straight strips of such width as you wish the length of the cylinders, say from one-eighth to three-eighths of an inch. Before removing the cylinder from the broach the end should be fastened by tucking it under with a small square-pointed instrument. When the whole cavity is properly filled with cylinders, they stand like cigars in a glass, as has been mentioned, and should be pressed together from the center, the space thus made

being again filled with cylinders and the operation repeated until the cavity is full, finishing with pointed cylinders. To make the latter take a sheet of gold-foil, cut into four squares, fold them down in squares to one-quarter or one-half inch or less if you wish them; fold the corners together making a triangle, place the broach in the center of the triangle, and roll it into a solid cone. A little practice will soon teach one just what is needed in the form of a wedge.

At the present time I have my cylinders made by rolling No. 2 and 3 soft foil on a piece of small steel, long enough to roll a whole sheet of gold. I then use No. 4 and 5 cohesive foil around the outside of the cylinder, which holds it together nicely. After withdrawing the steel, I cut the cylinders of any length I desire with a razor. The cohesive gold covering the outside of the cylinder is a great improvement, and the very thin non-cohesive foil on the inside makes a very soft and beautiful cylinder to work.

Dr. ANDREWS: I know something about Dr. Shumway's method. I have used it in my own practice, and believe it has merit. His manner of rolling cohesive gold is convenient, but these rolls are not cylinders. He uses gold in this form for making the first part of his filling as any dentist would. After a certain portion of the cavity is filled in this way, he cuts a leaf into small squares, anneals over mica, and burnishes or finishes the small square pieces of single thickness of No. 4 gold with ivory points to the filling already begun. By this method he claims that you can get a more perfect adaptation of gold to the walls of the cavity. I do not think Dr. Shumway has made himself clear by what he has said today.

Dr. CROUSE: The subject of root-filling has been very thoroughly gone over, and I shall say nothing on that topic, except that I consider it of very little importance what the root of a tooth is filled with, if it is filled to the end, or so that the opening at the end of the root is so perfectly stopped as to shut out all moisture. I wish to call attention to the remarks of the gentleman who preceded me, who said that he knew of no dentist whom he would allow to drill a hole through the end of a root to cure an abscess in his own mouth, hence he would not drill through the end of a root for a patient; that he would not have the mallet used on himself, hence he would not use it on a patient. Now if he will experiment a little on his patients he will find a great many of them will prefer the mallet to hand-pressure. In many cases it can be used with far less discomfort to the patient. Let him try it in some instances

where the pulp is dead, and he will find it good practice. But I wish to speak more particularly of the treatment of pulpless teeth preparatory to filling them. If the roots have an abscess, a cure can generally be effected by forcing carbolic acid through the root and through the fistula so that it shows on the gum. But there is another class of cases that are more troublesome and harder to treat, viz.: where the unhealthy condition exists, but where there is no fistulous opening or chance for the pus to discharge. The plan I adopt in such cases is to enlarge the opening at the end of the root sufficiently, so that if there is any pus there it can escape. I then force an instrument through the opening at the end to cause blood to flow and to break up the fermentation, and, as a rule, the trouble will end without further treatment. I have in mind cases that had given trouble for years, until I enlarged the opening and forced an instrument through, as just described, after which they were well in a very short time without further treatment. In one case, that of a superior bicuspid, the pulp had been dead for many years, and the tooth had been filled on each proximal surface. Being very frail, one of the cusps had broken off up to the gum. I decided to put on a gold crown. Removing the filling from the root, I treated several times and had the patient wear the crown temporarily for some months, but a cure was not effected until I opened to the end of one of the pulp-canals. I found the root bifurcated, and the palatal root had a sac from which pus discharged quite freely. It continued to discharge at times until I used aromatic sulphuric acid freely by forcing it through the opening I had made through the end of the root. After this treatment the tooth was soon well. I believe that in such cases, where the flow of pus will not cease, there is necrosis sufficient to retard a cure, and I know of nothing better to treat with than aromatic sulphuric acid.

I prefer treating through the root to drilling an opening through the alveolus to the end of the root.

Dr. Mills: Suppose the root was filled and you knew the condition of it. How would you proceed?

Dr. Crouse: If I had filled it myself I do not think there would be any abscess. If, however, there was an abscess, and I knew the root was as well filled as it could be, I expect I should drill through the alveolus. But such a case as I have described, of an upper bicuspid with bifurcated root and an abscess at the end of the palatal root, with no fistulous opening, could not be successfully treated through the alveolus, as you would injure one root while

trying to reach the root that had the abscess. One of the speakers who preceded me, in describing a case of alveolar abscess he had treated, told how much treatment he gave it in a given number of weeks. I asked how many times a day he treated it, and he replied, only once in two days; for the reason that his patient lived so far away he could not treat it any oftener. Don't you think it lucky for his patient that he lived a good ways off? Now, he committed what seems to me a very common error, that of treating too much or too often. After giving a case of alveolar abscess one or two thorough treatments, give it a rest, and let nature have a chance to do her part. I have in mind a case that I treated too much. I speak of this case because it is not as common as some. Each of the two superior bicuspids on the same side had a dead pulp, and both were filled. There was a very large abscess, with a fistulous opening, about midway between them and not as high as the ends of the roots. Of course, the first question to be decided was from which root the pus came. Both were a little sensitive to the tap of an instrument. The first had a defective filling in its anterior proximal surface; the other had a good one in the posterior proximal surface. I removed the filling from the first bicuspid, cleansed the root, and filled it with carbolic acid. Having cut a piece of rubber as near the size of the cavity as possible, I commenced pumping to force the acid through the root and out through the fistula. I was almost sure I had commenced on the right tooth, because about the time I commenced forcing the acid the pus began to flow very freely. I think, now, this was caused by some unobserved pressure I made on the gum or the other tooth. It misled me very much. So I worked a long time to get the carbolic acid through, but did not succeed. I did succeed, however, in getting the tooth so sore that I could scarcely touch it when she came again, a few days after. I then concluded I would remove the filling from the other tooth, and told my patient we would try and see if we could succeed as well in making the other tooth sore. I took the precaution this time, however, and have always taken it since, to use some milder medicine the first time. I got my rubber piston ready, having the root open and well cleansed, and used, first, phénol sodique. The first trial it came out through the fistula, driving the pus with it; then I forced carbolic acid through, and the disease was cured without any more treatment. It was six months, however, before the first one got over the treatment I gave it.

A VOICE: How many times a day did you treat it?

Dr. CROUSE: I treated it several times the first day; enough to give it a rest for some months.

I was very much pleased that the Section on Operative Dentistry presented that paper on soft gold and cylinder filling, for I am convinced that we cannot afford to have that plan of filling go out of use. I am also glad to know that so many dentists, and especially so many of the younger ones, are using cylinders and non-cohesive gold in their practice. I think the profession at large use too much cohesive gold; that is, I think non-cohesive gold is better for stopping decay in ordinary cases and for general use than cohesive. I do not advocate its use entirely to the exclusion of everything else. I think cohesive gold fills a place that cannot be filled by any other material which we know of at present. I used cohesive gold for a time exclusively, most of it number 60; and the fillings I then made, also those made by some other practitioners, at the same time, that have come under my observation, have stood splendidly. This was ten or twelve years ago; so I know that good fillings can be made with it and the teeth be preserved; but I am equally sure as good fillings can be made with non-cohesive gold, and in much less time. The tooth described by Dr. Webb as having a proximal cavity, which he would fill partly with oxychloride and partly with cohesive gold, I believe I could fill with non-cohesive gold, and fill it as well as it could be filled to preserve the tooth, while he was getting it ready to fill with cohesive gold. I am an advocate of non-cohesive gold for filling in general, on the ground that you can save much time and labor to yourself, and cause very much less fatigue and expense to your patients. Some cohesive gold, in connection with the non-cohesive, can many times be used to advantage.

I like the non-cohesive gold at the margins; especially do I want it at the cervical margins of proximal cavities. In such cases I know of nothing better than cylinders of proper size rolled tight and forced up against the cervical margin. I sometimes use several cylinders. I think all the advantage of non-cohesive gold is that it is more pliable, and consequently adapts itself more readily to the inequalities of the cavities.

There is another method which has not been spoken of which I think very much of, and which I have had very good success with, and that is the use of tin foil in back teeth, at the cervical margins of proximal cavities, finishing with gold. Tin being very pliable will adapt itself to the inequalities readily, and where that portion of the

cavity is hard to reach, it is more easily packed so as to shut out the moisture; after which the gold can be added and a very excellent filling made. There is one objection to this mode of practice, however, and that is, if such operations fall into the hands of other practitioners, they, seeing the dark lines which there will always be at the margins where tin is used, are liable to disturb the filling under the impression that decay has taken place above the gold. Excluding the objection named, I believe tin has an advantage over gold used in the way I have mentioned. Being more easily packed, the difficult points to reach are packed quicker and I think surer than in any other way.

In short, I believe it is our duty to operate in the way that is the surest of saving the teeth and that will occasion the least fatigue and expense to our patients.

Dr. WETHERBEE: Let us for a moment consider the several forms of gold which are denominated cylinders. The first to be mentioned is rolled upon a broach or any other instrument where the lamina of the gold is preserved, and is cylindrical in form. The so-called flat cylinder is rolled in the above described manner, and then flattened or compressed in one direction. Another way of making them is, first to fold the sheet of gold until quite narrow in width, then fold in squares until you have the desired thickness or quantity of gold. This last form was prepared by Dr. Clark, of New Orleans. The mode shown by Dr. Shumway is denominated "planished;" one piece of gold is laid upon another, and burnished down with ivory points. The proper method to pursue is to adopt such form of gold as will be found best suited to the cavity to be filled. If I have a crown cavity in a right inferior molar, I place my pellet or cylinder against the lingual wall of the cavity, and carry it firmly against the wall, and retain it in position while impaction goes on. Another pellet is placed against the one already condensed, and so on until the cavity is three-fourths filled; then a small pellet is placed at the floor of the remaining cavity, and added to, until the filling reaches nearly the crown surface of the cavity. Annealed foil is then used for completing the filling, and the crown surface is next thoroughly condensed.

The pellets or cylinders have been semi- or surface-annealed, which does not affect the soft working quality of the gold. All cavities may be filled in this manner, having the pellets the size requisite for the cavity.

As to the best method of treating alveolar abscess we have a di-

versity of opinion. It is claimed that an abscess should be reached through the pulp-canal. To facilitate the operation, the foramen should be enlarged to give free access to the part involved, either to an instrument or carbolic acid, or such dental medicine as the operator may prefer. If this method should be considered best for the superior incisors and bicuspids (against which I protest), it is not applicable to bifurcated bicuspids, nor to the mesial root of the first inferior molar.

When the pulp-canal of an incisor is properly cleaned and deodorized and perfectly filled with gold, the abscess in eight out of every ten cases will cease to furnish pus; the sinus will be closed by resolution, and subsequent inconvenience avoided. In patients of a strumous diathesis we have less certainty of immediate favorable results. In such cases I reach the abscess by drilling through the alveolar plate, at such angle as will allow of access to the end of the root, when with a small and delicate instrument the sac may be broken up, and then dressed with chloride of zinc. The sinus should be kept from closing by the presence of a small tent, until pus shall cease to form.

It is important that the filling required should have been completed previous to the treatment above described. If the above method is skillfully applied, you will have occasion to know that the practice of dentistry is not empirical, but conserving the interest of patients, long suffering, perhaps, but now honoring the profession.

With reference to the planishing method, every man has a right to his opinion, and to work in his own way. I concede to Dr. Shumway this right. It is required of him and all other practitioners that the results obtained shall be up to the point of excellence demanded. If there shall be failure in that direction, his intelligence should stimulate him to adopt such modes of practice as shall secure the highest possible attainments.

His (Dr. Shumway's) objection to the use of the mallet arises from his excessive effeminacy. He is supposedly always on the soft side of this question. If I am to fill a tooth of a delicate structure, I prefer the mallet, because my touch with it is as delicate and tender as my neighbor's hand-pressure who does not know how to use the mallet. If I understand my malleter and he understands me, the gentle touch of the mallet is no objection at all to the delicacy of the enamel, but its defense.

When I first used the mallet my patients objected to it from a false theory of its use. Now forty-nine out of every fifty would

rather have my gentle malleting than hand-pressure. With the mallet you never slip; with hand-pressure there is a possibility, even when the greatest care is used. I profess to be master of both modes of practice. I know what non-cohesive gold is, and how to work it; it works in my hands as kindly as cohesive foil.

Dr. SHUMWAY: In regard to root-filling, I simply want to mention a case that came to my notice only last week of a root that was treated and filled in Chicago recently—a left lateral incisor. The nerve-canal was drilled out through the apex according to the method recommended, and then the gold was malleted with such force as to drive the gold through the opening. Of course this foreign body caused an inflammation and ulceration worse a hundred-fold than the one it was intended to cure. In a little while a piece of gold came through from the outside and left a large opening.

Dr. PALMER: Dr. Crouse alluded to a combination of gold and tin for filling, with regard to which I wish to make some remarks, based upon practice and close observation. For a period of over seven years I have been trying to work up something by which to preserve teeth where amalgam would not be admissible, for we have cases where we would not use the latter; besides in a certain class of teeth, neither gold alone, nor amalgam, is the best material to use. There are two conditions which militate against the use of gold alone, one of which is controlled by chemical laws, the other may be regulated by the dentist and his patient. The latter is where economy is essential. It is not the fortune of all patients to be able to pay for gold. If teeth can be preserved within the means of patients who cannot pay for gold, it is the duty of the profession to provide such fillings. Regarding the first condition, I wish to mention where gold is not compatible with tooth-bone. The teeth contain twenty-eight per cent. of cartilage and conducting matter, and seventy-two of lime-salts, or non-conducting elements. We all know that variations of these proportions give various densities of the teeth. Teeth of even lower density than this standard are preserved with gold. From the lowest grade to the highest within its range of preservative power, gold is unquestionably the best material of which we have any knowledge. My position regarding it has been from the first that it should be used whenever and wherever it will preserve the teeth. In teeth below a certain standard of density, the combination referred to will be found more compatible with tooth-bone than gold; and in many cases less objectionable than amalgam. Dr. Crouse introduces the tin at the cervical base, which

was my method for several years. If but one or at most two layers of tin-foil be used as a lining, all right, but the soft condition of teeth often renders it necessary to fill a considerable portion of the cavity with tin, and finish with gold. Whatever the quantity of tin used I find it better to use it in combination with gold in alternate layers; the former method of rolling two sheets into a rope is quite apt to bring two or more thicknesses of tin together; the result is that the tin is liable to be dissolved by galvanic action and washed away, so that the surface of the plug will show depressions; whereas, if an equal amount of gold is used, or rather when but a single layer of tin comes in contact with gold, the two metals form an alloy as if fused together. When used in this manner, no such depressions occur; the gold preserves the tin. This molecular change takes place only at short distances, so I find that whatever amount of tin is used it is best to arrange it in alternate layers with the gold, which may be done by placing a sheet of gold upon a sheet of tin. Four leaves—two sheets of each—give a fair thickness; these may be cut into strips or blocks, as desired; the cutting fastens the edges. Whole plugs made of this combination are often as hard as amalgam, preserve the tooth the same as tin, and discolor the dentine no more than tin. Fillings may be made rapidly, as it works better than gold or tin alone. I would say here, that for large crown cavities in molars, I should rather first fill the cavity with oxyphosphate, and then cut away and finish with gold, because the oxyphosphate is a non-conductor as compared with a metal.

SECTION V.

ANATOMY, HISTOLOGY AND MICROSCOPY.

Reflex Action and Shock in the Dental Specialty.

PAPER BY E. S. NILES, OF THE SECTION.

THE part which reflex action plays in the physiological and pathological phenomena of the system is a subject of growing interest to medical specialists.

How often are the various systemic derangements in these busy, active American cities traceable to an over-worked or shattered nervous system.

The increase of the insane, eccentric, peculiar classes of people, and the consequent call for neurologists and nervous hospitals, urge upon us the necessity of a more thorough knowledge of the excitants of movements and functions of life, that it may be known what is compatible to the elements that sustain these forces.

Very little positive information is given us in the schools or text-books, and the field of study is somewhat barren.

The general divisions of nervous matter are being gradually mapped out, and before many years we shall be in possession of the location of the various centers or stations and the fields they control.

But the ultimate nerve-fiber and its mode of termination in the ultimate muscular fiber and origin in its center; the relation of one cell to another, or the intercellular substance; what the impulse is that is generated and proceeds like electric force along the nerves, and how it imparts life and action to the muscles and organs, are not yet determined.

These questions require a knowledge of the chemico-vital or molecular change which takes place in nervous protoplasm, about which present theories are but mere conjecture.

Out of the most plausible theories the writer of this paper has tried to draw some practical conclusions which may be of service to us; with no pretensions of originality except, perhaps, the presentation of the subject with reference to our specialty. What then is reflex action?

It has long been known, from experiments upon animals and decapitated criminals, that severing the head from the body does not wholly arrest muscular activity, and that under this condition action is governed by the spinal cord; for if this nerve-center is destroyed, muscular activity is at rest.

The ganglia or gray matter of the brain and spinal cord, and all ganglionic centers are regarded as giving rise to, or transforming impulses received through the sensory or afferent into impulses recognizable by the motor or efferent nerves. The white matter of the spinal cord performs a different office, independent of the local ganglia or of those ganglia that are involved and serve like nerve-fiber simply as conductors, connecting the higher with the lower centers. Thus, when the brain wills a movement, the cord may act simply as a conductor connecting the cerebral centers with the voluntary muscles brought into action; or when a habit is formed, as in the act of locomotion, the cord acts as a generator of stimulus to produce the action of the muscles of locomotion, and may receive, transform, and transmit nervous impulses.

The movements produced after the head is severed from the body are independent of sensation and volition, and may be called purely reflexed action, being reflexed back from the ganglionic structure of the cord.

The term "reflex action" may then be applied commonly in connection with a generation of nerve-force which occurs independent of the will.

Reflex movements, stimulated from the cerebro-spinal axis, are so intimately associated with the will that we seldom distinguish them from the voluntary; for instance, the man who fluently addresses an audience is employed with the thought of his subject, while the muscles of speech and articulation are, for the most part, presided over by lower centers; and the muscles of locomotion are usually governed in the same manner, in proof of which we know that people walk in their sleep, and postmen have walked distances of a mile and a half. We see the same muscles brought into use and the same actions as by the will. When during infancy we learn to walk, each step is carefully watched and directed until the

nerve-centers subordinate to the will have acquired the power of stimulating and governing these muscles.

The pianist first governs his fingers by the will, but the accomplishment is perfected in the acquirement of the power of concentrating the mind upon the effect, while the so-called "educated hand" wanders, almost without mental guidance, over the keys.

Respiration is for the most part reflex; its center has, I believe, been located in the medulla. Impressions upon the special senses —sight, hearing, smelling, tasting, feeling—may give rise to certain trains of thought by reflex centers.

Those movements which may be reflex or voluntary are mainly governed by nerve-centers situated in the cerebro-spinal axis.

Coming down lower in the scale of nervous action, we have what may be called a reflex system, commonly known as the sympathetic, which is made up of isolated ganglia intimately connected by nerve-fibers, so that a knotted net-work is formed and distributed through the visceral and various other cavities of the body. It differs anatomically from the higher system, in that its ultimate fibers are smaller, and the cells are characterized by the frequency with which they send out single prolongations. Those of the spinal system have six or eight, and sometimes more, filaments running from them.

The office of this reflex system is to preside over the functions of circulation, secretion, excretion, growth, and repair.

The more thickly clustered bodies of nervous matter or little brains are termed ganglia. Thus we have the cervical sympathetic following the course of the carotid artery; a thoracic and semi-lunar and various other little ganglia situated along the numerous arterial and nervous lines of the body.

To this system, especially, are due the constant and silent impulses that are always being sent out, whether we are asleep or awake, to stimulate and control our lives.

It is not yet conclusively proved by actual dissections or from the physiological standpoint, that there exists a system of nerves which directly preside over the nutrition of a part, called by Dr. Marshall Hall, excitor-nutrient and excitor-secretory, or trophic nerves.

No one will doubt that these processes of life are directly or indirectly under the control of the nervous system.

The existence of a vaso-motor system was conclusively proved to me by Professor Bowditch, of the Harvard Medical School; and as these nerves have the power of lessening or increasing the quan-

tity of blood to a part, they must indirectly exert a trophic influence upon the parts supplied. The vaso-motor system is distributed to the muscular walls or coats of the arteries.

The supposed trophic nerves would necessarily be distributed to the organ, enabling it to take from the blood just the kind of nourishment it needs. Thus the osseous system takes bone-forming material, muscle largely nitrogenous or albuminous substances, fatty tissue carbonaceous substances, and so on; the hair, nails and each tissue selects just the nourishment it requires for supplying its waste. The power in the organ to do this is said by some to be due to nervous influence.

Still lower in the scale of animal life is found automatic action, which has more or less local influence over the organ in which it is located.

The heart of a frog furnishes a good illustration of this mode of movement, as it is found to beat regularly for some time after entire removal from the body.

Cilia, spermatozoa, and the lower orders of animal life furnish the main source for the study of this form of action.

The duration of this mode of exciting action is much shorter in warm than cold-blooded animals; thus the study is rendered difficult, and its office is not well understood. In a physiological point of view, then, we may say the generation of nerve-force is derived from four sources:

1st. The will, the highest form of nerve-force.

2d. The higher reflex centers, embracing the whole cerebro-spinal axis.

3d. The purely reflex or sympathetic system, which controls the involuntary muscles, as those of the arteries and viscera, and movements stimulated by the sporadic ganglia of the thorax and abdomen, over which the will has practically no control.

4th. Automatic centers found in the organ itself, which may influence its function after entire separation from the body.

These four distinct exciting sources of the phenomena of life, although in a physiological point of view independent in some respects of one another, yet in the fulfillment of their office, their fibers are found to be so intimately associated, and ganglionic interchange of fiber occurs so freely, that it is hardly possible for one system to be stimulated to excess or to a great extent without affecting other centers. The nerve-fibers from the higher ganglia communicate with the lower, and the lower with the higher, with both sen-

sitive and motor trunks also accompanying each other to different stations or organs, the difference in the movement or peculiar function being in proportion to the number of nerves received from each system.

Thus a two-fold channel of communication is established between different points of the body, through the medium of nerves, cells, and intercellular substance, connecting the organs of the interior with the peripheral portions of the body, and through the channels of our special sense with the external world.

It is hardly necessary before an intelligent body like this, to call attention to the practical bearing of this subject upon our daily operations; but I beg your forbearance while I make a few applications.

In view of the intimate association of the parts of the oral cavity with the cerebro-spinal centers, not only through the five senses, (sight, taste, smelling, hearing, and feeling) but by osseous communication—so nicely illustrated by the audiphone—the practical conclusions are obvious in connection with our specialty. We come, then, to consider the question of shock in dental practice.

No one will doubt, that in nearly every operation there is a degree of exhaustion on the part of the patient after visiting the dentist; in degree, according to the nervous susceptibility of the person or time employed in performing the operation, pain inflicted, etc. And I wish briefly to direct attention to the various sources of this exhaustion or shock as they have occurred to me thus far in my practice.

The sight of our best cast-iron dental chairs, various smells about the dental office, the dental engines, with large heavy hand-pieces, which preclude the possibility of delicacy of touch. In my opinion, the flexible arm of the White engine will admit of a more delicate touch than the Johnston or Bonwill.

The various complicated electric or engine-pluggers are most admirably adapted to produce shock, especially in long operations. These are liable to have their accompaniments of ingenious power, water, steam, or electricity, which add to the bewilderment of the poor victim. Coarse-granulated corundums, sand-paper, and heavy burs, you all know may also be used at various times.

I have some fault to find even with our hand excavators and pluggers.

It is known to all of us that the more delicate or flexible the excavator or instrument, the more gentle will be its contact when we touch a tooth.

"Cold steel" imparts a disagreeable sensation in proportion to the amount of metal in the instrument, and as little of it as possible should be employed in making dental instruments. The old way of making not only pluggers but excavators with handles of wood is more in keeping with the gentle and kind treatment which not only our patients but nature's laws demand from the members of our specialty. These ideas point strongly, but I trust not too strongly to the "new departure." There is a wide distance in treatment between the man who pounds cohesive gold and the other extremist who uses exclusively plastic filling-materials, and it is my opinion that those who find the "happy medium" will reap the greatest reward.

I have passed an important point which properly comes under the heading of this paper, and that is the various constitutional derangements, chronic or temporary, that affect our specialty.

These may be classed as those that diminish the vitality of the pulp of a tooth, and those conditions which affect the tooth locally, as an increase of temperature of the mouth which naturally would be followed by stronger acidity; or the chemical composition of the saliva may be of such a nature as to throw down abundance of lime, mucus, etc.

All these often are the result of primary systemic causes, and the local manifestations with which we are often called to deal are but the reflex effect brought to our notice by this wonderful telegraphic system of ours.

The length of my article does not admit of following up these thoughts as far as facts warrant at the present time, but I trust enough has been said for the thinkers that may take the trouble to follow beyond.

SECTION V.—Continued.

The Present Status of Dental Histology.

PAPER BY C. F. W. BÖDECKER, OF THE SECTION.

FOR more than thirty years the cell doctrine was regarded as the basis of Histology. The founder of this theory was Th. Schwann, who, in 1839, announced that animal bodies as well as plants are built up by extremely minute vesicles, the so-called cells and their derivatives. This doctrine was greatly improved in 1850 by Rudolph Virchow, of Berlin, who, like Schwann, considered the elementary vesicle to contain a driblet of liquid with a nucleus suspended therein. This was thought to be the ultimate morphological element of the animal body. The liquid in the vesicle was regarded as the seat of life, and the point from which all multiplication or proliferation of the cells originated. In 1862, the cell doctrine was considerably modified by the late Max Schultze, of Bonn, Germany. This excellent investigator claimed that instead of a vesicle holding a fluid, there existed a jelly-like mass forming the body of the cell, and to this he applied the name, originally used by the botanist Von Mohl, "protoplasm." This substance, up to the beginning of the present decade, was regarded as a structureless mass, inasmuch as neither nucleus nor the granules which are scattered throughout the substance were considered essential features of living protoplasm. In 1862, L. Beale, of London, accepted the doctrine of Max Schultze, but by staining the specimens with carmine, he arrived at the conclusion that only the nucleus and nucleolus of the cells are living or "germinal matter." The jelly-like mass around the nucleus, as well as in the gluey basis-substance of the connective tissue, muscles, and nerves, is described by him as formed (dead) material.

In 1872, the doctrine of histology as accepted by the leading histologists was as follows: The animal body is composed of innumerable minute cells, which are built up by a "structureless," mostly

nucleated protoplasm; these cells being either suspended in a liquid (the plasma of blood, lymph, saliva, etc.), or inclosed in a jelly-like or more or less consistent intercellular substance, separating the cells from each other. It was also believed that direct communications of the cells with one another only existed in the myxomatous connective tissue, the muscles and nerves being regarded as derivatives of cells; thus, the source of these most active tissues of the body was thought to be a combination and fusing together of isolated cells.

It is obvious that, according to this view, the animal body is a compound structure of individual cells built up like a dwelling, the single bricks representing the cells, and the mortar between the bricks the intercellular substance.

In 1873, Carl Heitzmann, of Vienna, now residing in this city, established a new doctrine, which Louis Elsberg, of New York, has proposed to call "bioplasson doctrine." Heitzmann discovered a reticular structure in the protoplasm, and described the nucleus, the granules, the uniting threads, and also the inclosing layer around the protoplasm as the living matter proper, which is exclusively endowed with the capacity of motion and growth. The liquid, however, which is held within the meshes of the reticulum, he declared to be devoid of life. The elementary form of living matter is announced by C. Heitzmann to be a homogeneous, apparently structureless granule, of which sometimes hundreds may be seen in the small lump of protoplasm formerly termed a cell.

A second discovery by the same author is that all the tissues of the body and the formerly so-called cells, are connected with one another either directly, by broader offshoots, or indirectly, by a delicate reticulum of the living matter traversing the basis-substance. Isolated lumps of protoplasm are not met with except in the liquids of the body, such as blood, lymph, etc., which are not entitled to the name "tissue."

By the foregoing discoveries, the cell doctrine is changed entirely. Instead of pronouncing the animal body to be a mere compound of individual cells, we now have to consider it as one continuous mass of living matter, which contains within it closed spaces more or less occupied by liquids (the blood, lymph, etc.) In other words the animal body may be compared to an engine in which all the constituent parts are in uninterrupted connection with each other in order to enable the whole to perform its duty.

To-day, the presence of the reticular structure in protoplasm is

accepted by most of the leading histologists both in Europe and America. I refer particularly to the recently issued atlas of histology, by J. Klein and Noble Smith, of London, wherein the reticular structure is considered an established fact, and full credit given to its discoverer. In 1879, A. Spina, of Vienna, discovered a new method of preparing specimens of cartilage for microscopical investigations, namely, a particular treatment with alcohol, which enables anyone to observe the direct, as well as the indirect offshoots connecting the cartilage-corpuscles. In 1880, S. Stricker, of Vienna, observed that the protoplasmic bodies in the cornea were neither migrating nor isolated cells, the basis-substance of which may change again to protoplasm by assuming a reticular or a fibrillar structure, but that the basis-substance and the cornea-corpuscles were one continuous structure which, under certain circumstances, might assume the properties of either of them. Analogous observations by this same observer have been made on the epithelium of the cornea.

How, then, does the old cell doctrine stand in regard to the hard tissues of the teeth? Can the formation of dentine, enamel, cementum, secondary dentine, or a reformation of primary dentine be satisfactorily explained by the cell theory? The various stages of an inflammatory process—of which, since the excellent researches of Frank Abbott, caries is recognized to be a lower form—cannot, to my mind, be more clearly described by any other doctrine than the bioplasson. I am thoroughly convinced, gentlemen, that as long as you adhere to the old cell doctrine, you will not be able to realize the various physiological and pathological changes of the dental tissues.

In 1874 C. Heitzmann established in this city a histological laboratory, where his discoveries are demonstrated, and under his direction I have, during several years, very carefully studied the dental tissues, the results of which have appeared in a number of issues of the *Dental Cosmos*. They are in full harmony with the bioplasson doctrine in general, and as most of you, gentlemen, are not fully acquainted with them, I propose to recapitulate very briefly what I have found.

The lacunæ of bone-tissue are cavities within the glue-giving basis-substance, containing a protoplasmic body with a distinctly visible reticular structure, the latter to be regarded as the living matter of the protoplasm. In the basis-substance of the bone we find the canaliculi, which communicate with each other as well as with the

lacunæ. Between the canaliculi the basis-substance is pierced by an extremely delicate net-work, and only the very minute meshes hold the calcareous salt. The protoplasmic bodies present in the lacunæ send offshoots of living matter into the canaliculi. From the protoplasmic bodies situated within the lacunæ there are visible delicate conical offshoots, which, with their pointed extremities, are directed towards the finest canaliculi, where they are lost to sight.

The structure of the cementum is identical with that of bone, namely: It contains protoplasmic bodies within the lacunæ, offshoots of living matter in the canaliculi, and an extremely minute reticulum traversing the basis-substance.

On the neck, teeth present peculiar arrangements. The dentinal canaliculi, as well as their tenants, the Tomes fibers, do not quite reach the boundary of the dentine, but stop short of the cementum, where they end in a somewhat coarse net-work. In this vicinity no bone-corpuscles are present in the cementum. It is built up by spindle-shaped protoplasmic bodies imbedded in a coarsely granular basis-substance. By the presence of this superabundance of living protoplasm, the greater sensitiveness of the necks of teeth may be explained.

The canaliculi of the dentine as a rule are bifurcated only on the boundaries toward the enamel and cementum. Each canaliculus contains a central slightly beaded fiber of living protoplasm, which, on its whole periphery, is beset with delicate conical thorns. The basis-substance of the dentine, like that of bone, is pierced by a very delicate reticulum which connects all the dentinal canaliculi indirectly with one another, and which evidently contains living matter.

The enamel exhibits fibers of living matter identical with those of the dentine, but not so large. The fibers lie in the interstices between the enamel-rods, and upon their periphery we see the same thorn-like projections as upon the Tomes fibers of the dentine. The enamel-rods themselves show an extremely delicate net-work, which, under peculiar circumstances, has been brought to view in specimens prepared by Frank Abbott.

In the pulp all protoplasmic bodies of the periphery, as well as those imbedded in the myxomatous or fibrous basis-substance are united with one another, either directly by larger offshoots, or indirectly by filaments through the basis-substance.

In this way all formations of living matter, of the dentine, enamel, cementum, and the pulp are uninterruptedly connected with one another, by the surrounding pericementum with the bony socket,

and thus with the whole body. Hence, a tooth is composed of a series of wonderfully complicated living tissues, being a constituent part of the animal body, and is neither a compound lump of isolated cells, nor a dead mass of lime-salts.

SECTION V.—Continued.

Etiology of Chemical Abrasion of the Cutting-Edges of the Front Teeth.

PAPER BY ISAAC B. DAVENPORT, OF THE SECTION.

THE cause of chemical abrasion affecting only the cutting-edges of the front teeth has never been satisfactorily explained in any of our literature that I have been able to find upon this subject.

The condition itself is well illustrated and described in Harris's "Dental Surgery," under the head of "Spontaneous Abrasion," and is well shown upon the model which I will pass for your inspection, where you will notice that only the upper incisors and, to a slight extent, the canines are affected.

Sometimes the abrasion involves both the upper and lower teeth, and when fully developed leaves an elliptical space which exactly corresponds with the boundary of the labial commissure when open, as during ordinary conversation, or as in the natural position of those who have the habit of going with open mouths.

The cause of this form of abrasion Harris is inclined to attribute to acidulated mucus, which he supposes to be secreted by a mucous gland, which Dr. Nuhn, the German physician, claimed to have discovered in the tip of the tongue.

Good authorities have denied the existence of this gland.

If the theory of Harris is correct, the abrasion ought always to affect the lower as much as the upper teeth, which is not often the case; besides, the lingual and palatal surfaces ought to be most acted upon, at least during the progress of the affection, but just the reverse is true, for it is the labial surfaces that are *first* and *most* affected, as will be seen on the model before you, upon which the labial surfaces are worn much shorter than the palatal.

No longer ago than February, 1878, a paper was read before the Alumni Association of Philadelphia Dental College in which this condition was described. The conclusions of Harris were simply repeated, and no further light was thrown upon the cause.

In the second number of the *Ohio State Journal of Dental Science*, the editor, in reply to the query, "If in chemical abrasion or corrosion the abrading agent is recognized," answered, "Yes; lactic and acetic acids," basing his conclusions upon the following reasoning: "In abrasion the surface is left clear and clean, the organic and inorganic matter being removed to the same extent. This proves that the abrading agent forms soluble compounds with all tooth-substance, otherwise débris would remain. It also proves that the corrodent dissolves the two kinds of tooth-material with equal facility, for they are dissolved and washed away to exactly the same extent."

He says further: "Of all known acids but two have the necessary solvent powers above described; these are lactic and acetic acids, and these have the power only while in the nascent state."

While this may well explain that denuding process which we sometimes see on the labial surfaces near the gum, it is *not* a complete explanation of abrasion of the *cutting-edges;* for while *these* acids may cause this condition, they are not the *only* acids which do it; nor is it necessary that the corroding agent be one that removes equally the organic and inorganic constituents; for if *any acid* which dissolves lime-salts be brought into contact with the cutting-edges of the teeth, the same result will follow, viz.: a smooth, abraded surface; because the soft organic materials will be polished away by the food, lips, and tongue as fast as solution of the inorganic elements advances.

In 1875 the following case was noticed, from which the model now in your hands was made.

It was that of a man twenty-nine years of age, of robust physical development, with teeth of excellent quality, there being no decay in any of the upper teeth, although some of the lower molars had been lost. The superior central incisors were worn away one-half their length, the laterals to a less extent, and the canines a very little; the other teeth were not affected. Thus a wide space was left between the upper and lower incisors when the teeth were closed. No teeth could be seen during conversation, as they were worn away even with the line of the lips. The lower teeth, being completely covered, were not affected.

Up to eight years before, the patient had lived upon a farm, and at that time his teeth were perfect. He then engaged as a workman in the manufacture of nitric acid and oil of vitriol, when, to use his own expression, "the gases escaping from the retorts set his teeth on edge, and he soon noticed that they were wearing away."

He also stated that the teeth of all the other workmen were more or less affected, according to the extent that they were left uncovered by the lips; in some both the upper and lower teeth were involved.

The patient stated that the entire wearing away of his teeth had been accomplished within six months after entering the factory, during which time the abraded surfaces were sensitive to touch, heat, and cold.

When seen by me there had evidently been no progress of the affection for a long time, and the teeth were free from sensitiveness.

One month after the above case was noticed, another appeared in which the abrasion was in progress. The patient, a man about thirty-five years of age, had for a short time been employed in Professor Mowbray's nitro-glycerin works, where nitric and sulphuric acids were manufactured and used in making nitro-glycerin.

The labial surfaces of both upper and lower incisors were worn away one-half their length, being beveled off from a point corresponding to the line of the lips, to the palatal surface, and involving the cutting-edge; but as yet the shortening was only slight. The patient said that "most of the wearing had been accomplished within two weeks after entering the factory, since which time, he had learned to keep his mouth closed while at work. Some of the workmen protected their teeth by wearing thin pieces of gutta-percha molded upon their labial surfaces."

In all the cases I have seen or investigated, there had been exposure either to the fumes of nitric acid alone, or to nitric acid and oil of vitrol. The fumes developed in the manufacture of nitric acid are nitric oxide, which, coming in contact with the moist surfaces of the teeth during respiration, forms nitric acid. Oil of vitriol is a mixture of sulphuric acid and sulphuric anhydride, the former being non-volatile, but the latter is highly volatile, and this uniting with the moisture on surfaces of teeth forms sulphuric acid.

In a communication from Prof. Chas. Mayr, chemist, of Springfield, Mass., well known to you as a writer upon scientific subjects bearing upon our specialty, he says: "It is easily explainable in your cases, why *just* the incisors and canines were cut off. A person

breathing through the mouth must necessarily draw the acid air over those teeth and the acid condenses upon them, dissolving the lime-salts, and the food, tongue, and lips slowly remove the softened tooth-substance. The molars do not come much in contact with the acid air, first, because the greater part of the acid fumes have been absorbed and neutralized by the incisors, etc.; second, because the stream of air rushes straight from the mouth to the trachea without reaching the remote corners."

"Vapors of volatile mineral or organic acids when inhaled through the nose are quickly neutralized and have no effect on the teeth." "This action, erosion and solution of the teeth by acids, is well known to chemists, and we keep our mouths closed when experimenting with acids." "The destructive agent in these cases is not any *peculiar* acid, but *any* acid, provided it is volatile."

Prof. Mayr also mentions another essential condition for preservation of the teeth in an acid atmosphere, viz.: "That the lips be dry, as on moist lips acid vapors will condense, and upon opening the mouth be brought into contact with the incisors and canines, and the same results follow as when the fumes are inhaled."

From the foregoing considerations, may we not safely conclude that the etiology of chemical abrasion of the cutting-edges of the front teeth (or the so-called "spontaneous abrasion" of the older writers) is the direct contact with the teeth (by inhalation) of any *acid*, mineral or organic, which is capable of dissolving lime-salts?

DISCUSSIONS ON REFLEX ACTION.

Dr. Bödecker: Dr. Niles is not quite well-informed as to the nervous supply. The gray matter, or axis cylinder, is continuous from the nerve-center to its termination, and is enveloped in the white substance of Schwann. Dr. Niles stated also that the nerves are intimately connected with the ultimate muscular fibers. I have never seen it. The nerve enters the myolemma and there is lost to sight.

Dr. Atkinson: I would ask what reflex action is understood to be by those who use the term so freely. I have never seen any definition that was satisfactory to my mind, so as to enable me to comprehend the origin and terminus of an impact of energy that could be called reflex action, unless all the physiological actions of the body are not carried on by that very process. I think this is a field as yet nearly unexplored, that will have to be comprehended and

wrought out before we shall be masters of this question. We say we understand the nervous system, and yet we have different views put forth by different physiologists in the text-books, and we see much difference of understanding of what is perceptible under the microscope as to the distribution of the nerves. As far as I understand it, the sensory or motor nerves have no characteristic definition under the microscope as to the manifestation of their functions. Dr. Bödecker said, what I have seen and have never known in the mammalia to be different, that the interior of the nerve, after losing the cylinder of Schwann, enters into a sort of basis-substance; that point has not been decided,—whether it is nerve or not. I have had the temerity to call all that tissue neural mass or nerve mass. It has been called by some protoplasm; and I think it is not a very great mistake to say it is protoplasmic basis-substance at least. Now, if we take into view the function of the mollusca, which are white-blooded animals—the jelly-fish, oyster or mussel, or clam—we shall learn that there is a circulation there as clear and distinct as blood circulation; endowed with blood-corpuscles and fluid blood, and that the tension between the central and peripheral sinus keeps up the circulation. I take it that this is the secret of reflex action, and that what the power is that produces it has yet to be discovered. We may guess at it, and talk, as we think, very learnedly about it, as we hear *ad nauseam*. When everything and anything abnormal takes place, every one says it results from irritation, without defining what the irritation is. I take it that "irritation" is the disturbance of the balance of tension of the circulation between these blood islands—shall I say they are blood cavities? They are sinuses in which the blood is held in large lake-like conformations, and whatever that tension is between them that keeps up a round of circulation, is the basis of our reflex action. It is well known that when a motor nerve is cut nearly off, spasm of the muscles to which it goes is induced (and some of our dental associations, probably, are very much exercised by what is called reflex action), which ceases at once when the remnant of the nerve, that does not seem able to convey this tension, is cut. I am not saying this in any other spirit or any other hope than as putting up a finger-board towards the direction from which I hope an answer may come, but at the same time I want to say,—it may be through my ignorance, —that I have never heard reflex action satisfactorily accounted for by any physiologist, and I have never read of it in any book, and yet I have memorized a good deal, and I have known others who memor-

ized a good deal that has been written on that subject. Hearing, seeing, tasting, smelling are all instances of reflex action, if not, indeed, every one of the secretory actions of the body and all molecular changes. You are, all of you, aware of the effect of any savory substance addressing consciousness through your sight, causing a flow of saliva, adapted to dissolve that special substance from which that odor arises. If it is from the eye, you judge from past experience. In investigating these subjects it has been said, that substances with which we are not acquainted, but which act upon us when brought in direct contact, do not excite reflex action. I say this to show how very careful we should be in attempting to account for appearances, by only mentioning a few of the facts that have fallen under our observation. I am very fond of facts, and am very fond of the records of facts, but I am very much more delighted with correlating these, inasmuch as consecutive order is the relative beginning and ending of the process that we call reflex action.

Dr. Barrett: In the discussion of the subject of reflex action, or of nervous activity, of nervous force, it is important that we have a definite starting-point. We must first determine what is nervous force; what is its origin, and thence endeavor to trace out the laws which govern its manifestation. To do this we must go back to the origin of all force, and that is, indeed, getting at the roots of things. It underlies all phenomena of whatever kind. It is believed at the present day that light, heat, electricity, and chemism are but modes of motion; that they are but the result of certain molecular changes which are continually going on; that they are mutually convertible, the one into the other. The electric light, which is even now illuminating the street outside this hall, is an example of the conversion of electricity into light, or it is another mode of manifestation of the parent and unit, force. In the galvano-cautery we see electricity converted into heat. In the galvanic battery we see chemism converted into electricity. In the thermal pile, heat is converted into electricity, and thus it may be seen that one force is readily converted into another. Nervous force is but another mode of this manifestation, for why should we say that the law is general and holds good through the lower planes of force, and that it fails us when we come where we most need its application. If an animal be anesthetized and the pneumo-gastric nerves exposed and raised upon the point of a glass rod, and if we now after opening the thorax and exposing the heart, apply the poles of a battery to the pneumo-gastrics, all the phenomena of life will be observed, even though the

animal be quite dead. The heart can be made to dilate and contract, its systoles and disastoles observed the same as under nervous impulse; and what is this then but the conversion of electricity into nervous force? It cannot be said that it is the direct power of electricity acting upon the muscles of the heart, for there is here no closed current. Again in the gymnotus, the electrical fish, the special apparatus which is the source of the shocks is evidently a part of the nervous organization. Light does not differ from heat, nor heat from electricity, except in the mode of manifestation. It seems to me quite as evident that nervous force is dependent upon, and has its origin in, the molecular changes constantly going on in the body, and that it is but another manifestation of that parent force which in other forms we call heat, light, electricity, and chemism. It is more complicated in manifestation than they, but that does not alter its character. It is that mysterious thing which we call life, vitality, the ghost, the soul.

Dr. BUCKINGHAM: I do not know that I can throw any light on this subject. It is one of the most difficult subjects with which we have to contend. The theory of some is that forces are entities and can be changed one into another; others regard them as nothing but motion. Allowing them to act by motion, how can we conceive of motion originating itself, and how can we explain motion being changed without some force to change it? What is that force? Where does it come from? How does it act upon matter? Can we conceive of anything that will move but matter? You all know that in order to explain light as a series of motions, we have to conceive that space is filled with a substance called ether. We cannot prove that the ether exists, and we cannot explain motion unless there is some material substance to move. It is calculated that the atmosphere extends about forty-five miles above the earth, and the sun is over ninety millions of miles from us. Now, there must be something in this vast space between the sun and our atmosphere to move, if light is nothing but a series of motions; hence we must adopt this theory of an ether, or else say light is an entity, and is projected out and passes through space.

Oersted, more than half a century ago, advanced the beautiful idea that "The laws of nature are the thoughts of God." When we endeavor to explain some monstrous process, we select some analogy which we can understand, and I think we may illustrate the natural force by referring to our civil laws. Blackstone, more than a century ago, explained laws to be "that rule of action which is pre-

scribed by some superior being, and which the inferior is bound to obey. Thus, when the Supreme Being formed the universe and created matter out of nothing, he impressed certain principles upon that matter from which it can never depart, and without which it would cease to be." When he put that matter into motion he established certain laws of motion to which all movable bodies must conform. I am not going to give a lecture on theology, but whether we believe or not in a creation as described in the Scriptures, or in some other mysterious way that we cannot explain, the fact still remains that we have matter and force, and that matter cannot exist without force. The best explanation of the origin of light that we can have is in the Scriptures. "God said let there be light and there was light." Light can be analyzed, separated into its various colors, and it can be demonstrated that it comes in wave lines and produces an image on the retina, but how it produces the effect we call light upon the brain is a mystery we cannot explain.

We often hear of one force being changed into another—heat into light, electricity into light; we never speak of one law being changed into another, although the various laws are propagated alike, nor do we speak of one note in music being changed into another, and yet they are all produced by motion. So with the natural forces; one kind of motion produces heat, another light, and still another electricity, and these produce different sensations on the brain. How these sensations are recognized we cannot tell, amd probably never will. They are what Spencer terms unknowables. We may trace light until it prints an image on the retina; then we are at the end of our course. We can follow sounds into the ear; there the brain takes cognizance of them, and how we become conscious of them we cannot tell. So with the action and reflex action of the nerves. We can by trials find that injury to one part may produce pain in another, and by repeating the trial find the effect constant and therefore set it down as law, but the reason why the effects are so transmitted we do not know.

DISCUSSIONS ON DENTAL CARIES.

Dr. Abbott: Four years ago Dr. Bödecker and myself took it upon ourselves to investigate the minute anatomy of the teeth in health and in disease, Dr. Bödecker taking the structure of the tooth as his division of the subject, while to myself was allotted the study of dental

caries. The results of our researches were published in the *Dental Cosmos*. [To assist in elucidating his remarks the speaker used a number of very greatly enlarged colored drawings.] As we all know, a tooth consists of dentine, enamel and cementum, and the pulp. You will observe a direct connection between the pulp and the tissues outside the tooth. The protoplasmic bodies are in direct connection with the living reticulum in the dentine and the cement, and also with the periosteum.

FIG. 1.

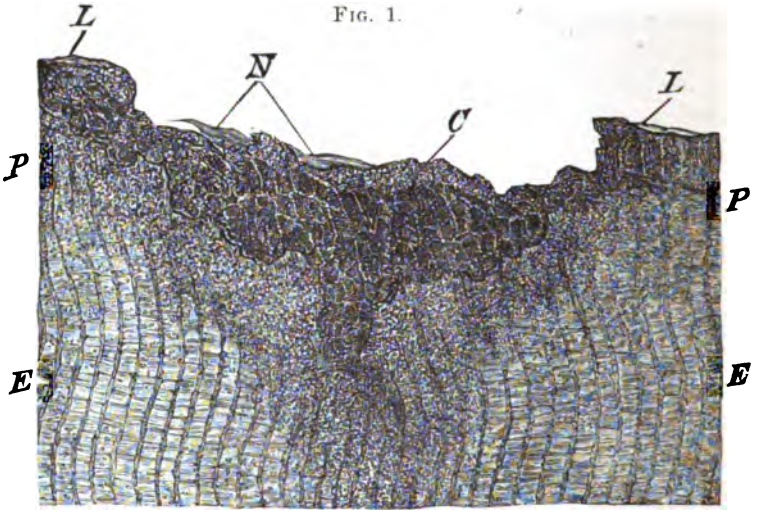


Figure 1 is an illustration of caries of enamel. All the living matter in every direction is connected, so that whenever one part is affected all of the tooth is more or less affected, because the life extends everywhere. I do not think this statement will be contradicted, that decay always begins with the dissolving out of the lime-salts of the enamel by the chemical action of some acid. Every tooth in a normal condition is free from decay, and it will not decay so long as it is kept in a state of perfect cleanliness. The enamel of the tooth is composed of 96½ parts of inorganic (principally lime-salts) and 3½ parts of organic matter. The illustration looks as though, while the continuity of the boundary was preserved, pieces of the surface had dropped in, having lost their supports. At the bottom the structure is nearly normal, only a little of the lime-salts being dissolved out; higher up it is more granular, and a step further and we come to the cavity of decay. We have

here a return of the enamel to medullary or indifferent tissue. As soon as the lime-salts begin to be dissolved out, an inflammatory reaction is set up which reduces the tissue to its original condition. As it progresses from the surface, we find the whole structure broken down, little by little, through the enamel to the dentine and possibly to the ultimate destruction of the tooth, unless its course is checked. Decay occurs either as chronic or acute. In chronic decay we have a different condition from that which characterizes the acute form. My observations show that decay assumes an acute or a chronic form, according to the perfect or imperfect calcification of the tooth. When the periphery of dentine is but little changed, and a narrow zone of yellowish color forms the boundary toward irregular shallow excavations, sometimes with various shaped elongations passing down into the dentine, it is called chronic caries, because of the slow course it runs. Low vegetable organisms are never seen in the substance of a decayed tooth. They may accompany it, but not as an exciting cause. If the pulp be dead there is no reparation. The acids go on to the destruction of the tooth, assisted only by putrefaction of its organic portion. Meat decaying gives as one of the products lactic acid, which is an active agent in the destruction of tooth-substance.

In acute caries we have deeper elongations into the substance of the dentine, mainly in the shape of fissures running independent of the direction of the dentinal canaliculi,—frequently across them. Sometimes these fissures seem completely isolated, but the probabilities are that they are connected in some way with the mass of decay. Sometimes the connection is by means of tracts of partially broken-down dentine. Viewed with a low power, say 250 diameters, the fissures seem to be filled with a granular mass, the remains of the former tissue. With a power of 1000 diameters we find that at a certain distance from the cavity the dentinal canaliculi look unchanged, and each contains the central transverse section of the dentinal fiber with its delicate offshoots. Approaching the cavity, the canaliculi become enlarged, and are filled with yellow protoplasm, in which is seen the net-like arrangement of the living matter. Still nearer the cavity the canaliculi are enlarged to many times their original size, sometimes several running together, forming a confluent cavity, and the basis-substance entirely disappears, and only indifferently formed protoplasmic bodies are visible. If a cavity in which acute caries has been at work is properly sealed up, recalcification will occur, but the dentine will be of a widely different

character from the original formation. The meaning of the enlarged canaliculi is, that the lime-salts have been melted down by inflammation. If the inflammation which produced it were taken away, recalcification would probably take place.

In caries of cement we have exhibited first all the phenomena known to be present in the early stages of inflammation of bone. Cement is almost identical with bone, having the same structure. If cement was subjected to the same conditions as enamel and dentine, its decay would be much more rapid, as evidence of which we all know how soon we have little holes all around the necks of teeth after recession of the gum, when food débris lodges and ferments there. Decay in cement is in its essential features analogous to caries of dentine when in a live condition; in other words, it is an inflammatory process. On the boundaries of the caries we see, besides unchanged cement-corpuscles, those which have been enlarged and transformed into medullary or inflammatory elements.

Down to 1831, I believe it was, all writers spoke of decay of the teeth as inflammation. Magitot, in 1868, stated that it was due altogether to a chemical process. Leber and Rottenstein claim that the leptothrix crawl into the canaliculi and enlarge them, so that the destructive agency can follow. I never saw such a thing as vegetable organism assisting the progress of decay. Even Tomes states that the process is simply a dissolving out of the lime-salts, treating the tooth the same as Magitot.

Dr. CHANDLER: Has Dr. Abbott followed Leber and Rottenstein's method of staining specimens?

Dr. ABBOTT: No, sir. The method used in preparing dentine and cement was slow decalcification, by means of a one per cent. solution of chromic acid; at least two months should be required to prepare the superficial layers of the tooth for cutting with a razor. To prepare enamel, the method first practiced by Dr. Bödecker was employed—splitting perfectly fresh teeth, by means of a saw, into thin lamellæ, grinding these down to the necessary thinness under water, and immersing the thin slices for partial decalcification in a one-half per cent. solution of chromic acid, for an hour or two.

Dr. NILES: Did I understand that the inflammation of the tooth-substance was caused by the pulp. If so, how do you account for decay in a dead tooth?

Dr. ABBOTT: No; it is an outside influence. Decay in a dead tooth is assisted undoubtedly by the decomposition of the organic matter of the tooth-structure.

Dr. BUCKINGHAM: Dr. Abbott uses the term inflammation of the dentine. What is inflammation? If we take the old phenomena of heat, color, swelling, and pain, and contend as some do that all of them must be present to constitute inflammation, then inflammation cannot take place in the dentine; but if we recognize it to be an excited state of nutrition running on until it ends in death of the part, then it may take place in dentine. May not a tissue die without being inflamed? and when dead it would decompose, or decomposition might go on to a certain extent without the tissue being inflamed or dead. The lime-salts are not essential to its vitality. We have frequently over the pulp a portion of dentine that is deprived of the calcareous matter, and yet it is alive. If it were dead it would not become recalcified, as it often does.

Dr. BÖDECKER: Dr. Buckingham, at the session last evening, wanted to know what is inflammation, and in his remarks stated the old doctrine of forty years ago, when the blood was supposed to be the principal if not the only agent in the inflammatory process. This theory has been considerably modified. Virchow said the blood-vessels had nothing to do with inflammation except to furnish material to be taken up by the cells, which he considered the primary seat of the inflammation and the only active agent in its production, inasmuch as they only could produce new cells; pus, in his view, was but the product of the cells. Cohnheim observed that in irritated tissues there exuded from the capillaries and small veins white blood-corpuscles, and he claimed that all inflammation was started by the emigration of the white blood-corpuscles. The fixed cells of the connective tissue do not, according to this investigator, share in the inflammatory process, but they are replaced by the emigrated white blood-corpuscles, which after having passed the walls of the blood-vessels represent pus-corpuscles, and by accumulation form a center of suppuration. Stricker, on the contrary, taught that not only the cells and blood-vessels are implicated in and necessary to the inflammatory process, which he claimed could not be produced in tissues separated from the vascular system, but that the cells swelled so as to kill or absorb the basis-substance; that all the offshoots of the cells may share in the inflammatory process through proliferation. According to this view, every inflammation should result in the formation of pus-corpuscles, which is not the case. All these views were based on only a partial knowledge of the ultimate structure of tissue. It was not until Carl Heitzmann published his discoveries in the microscopic anatomy of the connective

tissue that there was any proper comprehension of inflammation. According to him (and his views are now generally accepted as correct) the living matter is present not only in the formerly so-called cells and their coarser offshoots, but it pervades every portion of the connective tissue in the form of a delicate net-work; hence it follows that it will react upon the irritation, both in the protoplasmic bodies and in the basis-substance. The latter is merely liquefied, the reticulum of living matter becomes visible again, and thus the embryonal condition of the tissue is re-established; that is to say, inflammation is merely the return of a tissue to its embryonic stage. The embryonal elements (which were originally connected with each other by the delicate threads of the living matter) and their offspring represent what is termed the inflammatory infiltration. By a re-formation of a basis-substance there is a new amount of connective tissue, and the inflammation results in hyperplasia of this connective tissue. If, however, the inflammatory elements are torn apart, the inflamed tissue is transformed into pus. In the former case the inflammation is physiological, and results in a new formation of tissue; in the latter it is pathological, and there ensues a destruction, that is, a transformation into an abscess. Bone-tissue originates from the embryonal elements, which, in the majority of instances, are first formed into cartilage, then back to the embryonal state, and thence by the infiltration of lime-salts are transformed directly into bone. [Dr. Bödecker illustrated the process of tissue-formation by sketches on the blackboard.] The same steps take place in the inflammatory process. When the inflammation commences it dissolves out the lime-salts, and you have the original embryonal tissue. When it tends towards the formation of pus, the connections between the protoplasmic masses perish, and we have the isolated corpuscles floating in a serous fluid. Unless the course of the inflammatory process is changed, these perish, as there are no blood-vessels in the tooth, and decay follows.

Dr. Niles: I understand the theory of the inflammatory process so well described by the gentleman who preceded me, and which is laid down in our most recent works on pathology, and I agree with him so far as it is applied to soft tissue or hard tissue supplied liberally with blood-vessels, but I cannot make the deduction that the same process ever exists in the decalcified organic substance or matrix of a tooth, to aid or assist the tooth decay.

The lime-salts in the carious cavity of a tooth, every one must admit, are in an acid solution, which acid has the power to act upon

the tooth-substance to dissolve out the lime or mineral matter, and finally reduce the animal matrix to a soft, gelatinous mass, which Professors Abbott and Bödecker term embryonal protoplasm, or "a return to an embryonal condition." The only action that I know of about decalcified teeth that may be likened to an embryonal condition, is the absorption of deciduous roots; where there is no acid reaction, the whole tooth, mineral and organic, is completely absorbed. At the outset I will say, and Professor Abbott will agree with me, that if a tooth is kept free from acids there will be no decay. In regard to the question which I raised yesterday, or the fact that a dead tooth decayed faster than a live one, Dr. Abbott stated that inflammation assisted decay "very much," and that the exciting cause of it came from the pulp; according to that theory, a living tooth decays faster than a dead one. Suppose this to be the pulp of a tooth which is living and the caries sets in at this point. You believe that inflammation is in progress at this point, passing towards the pulp?

Dr. Abbott: The organic substance is returned to its medullary condition.

Dr. Niles: Suppose this is filled with decalcified organic substance; inflammation would be in progress at this point, would it?

Dr. Abbott: Passing toward the pulp.

Dr. Niles: Do you recognize that there is an effort on the part of the pulp to stop that progress?

Dr. Abbott: Not necessarily.

Dr. Niles: Have you made sections of tooth decay?

Dr. Abbott: Oh! yes, sir.

Dr. Niles: You will find an effort has been made by the pulp to fill up the tubuli indicated from this point. If you consider that action of an inflammatory character, I concede your views in that particular, but it tends to arrest, not to facilitate decay. It is a thickening of the dentine to arrest the inward progress of decay; and if this is effected, there is a circumscribed portion of that tooth about the cavity more dense and much harder than other portions of dentine. This, I believe results from the filling up of the tubuli. Is that your point of inflammation?

Dr. Abbott: That is the point.

Dr. Niles: You call the ossification or filling up of those tubuli an inflammatory process?

Dr. Abbott: No, no; Oh! no, thank you.

Dr. Niles: That has been my only idea, and the only explanation I can find of inflammation in tooth-structure. We find an illustration

when, after a cavity has been excavated and filled for a time with gutta-percha, on removing it an increased sensitiveness is found. The non-conducting properties of the filling cause a retention of heat at the point where the tubuli are being calcified. If an alkaline solution be turned into the cavity, or the acid neutralized, all of Dr. Abbott's embryonal or inflammatory processes will vanish. Magitot has demonstrated these points clearly, and I have, to a certain extent, reproduced his experiments.

Decay or dental caries may readily be produced out of the mouth by immersing a tooth in any acid capable of removing the earthy salts, leaving it there only a few days or weeks, according to the strength of the acid. The lime-salts will be gone, and only the organic portion of the tooth left,—that which we daily remove from cavities in the process of filling, calling it decay; if this is left in the acid for a still longer time it will become soft and gelatinous. This I understand Dr. Abbott calls an "embryonal element."

I should like to ask Professor Abbott how he prepared these specimens.

Dr. ABBOTT: The specimens are prepared by immersion in a weak solution of chromic acid, to which are added a few drops of hydrochloric acid every two or three days, and thus we dissolve out the lime-salts preparatory to cutting with a razor. The lime-salts are not held in solution, as in the case of inflammation of a tooth in the mouth, but are dissolved out, and they disappear from its substance altogether.

Dr. NILES: You made the sections of decayed teeth after decalcification?

Dr. ABBOTT: Yes, sir. We do not decalcify specimens of enamel, however, before preparing, but we grind and keep them moist from the time they are taken out of the mouth, until they are put under the glass.

Dr. NILES: This is certainly prepared in that way. Generally, Dr. Abbott will agree with me that acids are the exciting and primary cause.

Dr. ABBOTT: Primary cause.

Dr. NILES: They decay this portion of the tooth.

Dr. ABBOTT: I will not admit any such thing. Acid was the primary cause.

Dr. NILES: We will suppose that I add a little acid here, and that is the exciting cause. Now there is more or less acid in the cavity?

Dr. ABBOTT: When the cavity is formed there is more or less.

Dr. NILES: And it will give an acid reaction?

Dr. ABBOTT: Yes, sir.

Dr. NILES: Now, how am I going to preserve this carious specimen as it now is during the process of preparing for microscopic examination. Can I immerse it in another acid before making a section? Does not that acid have the same effect as the one at work in the cavity when the tooth was extracted, and does not decay progress as before and the condition of the cavity become changed? I think it does, Gentlemen.

The chromic and hydrochloric acids are good solvents for tooth-substance, and this is the way teeth are prepared when tubuli want to be examined; but sections through decayed cavities of teeth should be treated wholly by grinding; then you would see the tooth in the exact condition it came from the mouth, and not the results of the action of acids. Tomes and Magitot, I believe, first harden the animal portion of the tooth with alcohol, then grind this section on very fine corundum, finishing on Arkansas stone and polishing, keeping it moist through the whole process.

Mr. Tomes's present theory of the formation of the dentine from what at last become odontoblasts that cover the surface of the pulp will hardly admit of this theory of a return to an embryonal condition. I think, if I understand Dr. Abbott correctly, his theory of decay conflicts very materially with the present accepted theory of tooth-formation and development.

Dr. ABBOTT: Dr. Niles, intentionally or otherwise, misunderstands my position. We do not immerse enamel in acids, because we want the lime-salts for strength during the grinding process. We have dissolved the lime-salts entirely out after grinding, and have shown the net-work of living matter as perfectly under a power of 500 as you can see my hand. It must be understood that we are not preparing these specimens to look at lime-salts. Grinding either tears away or disfigures the organic matter, or renders it imperfect for purposes of observation. The object of putting into the chromic-acid (one-eighth of one per cent.) solution is to preserve the organic parts exactly. The solution must not be strong enough to disintegrate the enamel. The moment the living matter is exposed inflammatory action is set up, which is simply a return to the embryonic condition, and from which we may have the redeposition of lime-salts. In the old definition of inflammation, as given by Dr. Buckingham, swelling is noted as one of the characteristic symptoms. If this be true, how are you going to get inflammation in a

tooth, which cannot swell. The fact is that the inflamed tooth does the same as the inflamed soft tissues. It is reduced to its embryonic condition, from which it may be again differentiated into normal tissue, by the same process that originally formed it. The primary cause is a solution of the lime-salts by some solvent, some acid—something which has an affinity for the lime-salts. Unless this is checked it goes on until a portion of the tooth-structure is destroyed; the inflammatory process passes down towards the pulp, and the canaliculi are enlarged by the melting down of the organic matter, by which the lime-salts are thrown out and held in solution. There is no such thing as a filling up of the canaliculi, or vitrifaction. There is no attempt on the part of the pulp to stop the decay, except that when the inflammatory action is stopped recalcification begins.

Dr. CHANDLER: I understand Dr. Abbott to say this zone of resistance does not form until the outer cavity is stopped?

Dr. ABBOTT: Oh! no; I do not mean any such thing.

Dr. CHANDLER: That zone, as I understand it, is found in every cavity?

Dr. ABBOTT: Certainly it is.

Dr. CHANDLER: And you will find it in every cavity, be the cavity ever so small?

Dr. ABBOTT: Certainly.

Dr. CHANDLER: Leber and Rottenstein also take this ground. There is another point I noticed last night. In this section you refer to the appearance down here (pointing to the board), to the fact of this inflammation running through nearly sound dentine, and affecting the dentine below. This, of course, is partially decalcified. You speak of the effect going on below. How do you know the two carious spots have anything to do with each other? How do you know this does not belong to a part of the tooth you have cut through in making your section? How do you know it is part of the same trouble?

Dr. ABBOTT: I did not have any carious place out here.

Dr. CHANDLER: Are you sure of it?

Dr. ABBOTT: Yes, sir.

Dr. CHANDLER: I should be rather inclined to doubt that the caries there (pointing) has anything to do with this caries here (pointing). If that were simply a portion of the commencement of the zone of resistance, I might believe it, but that caries as such—this solution of lime-salts—has taken place from this inflammation above, I cannot believe. That, I believe, is another portion of the same, or another

carious cavity which is running underneath the dentine and enamel, and he has cut through that which has nothing to do, properly speaking, with the part of the section above.

Dr. BUCKINGHAM: Dr. Abbott, as I understand him, almost ignores any vital action in inflammation. Inflammation is pathological, and vitality is necessary for its production. Cut off a piece of cartilage, and it becomes dead and cannot go through the process of inflammation, though it will become decomposed. If dentine loses its vitality we cannot have inflammation, and yet the decay goes on. My idea is that all tissues are formed in a fluid; what this is composed of is not known. Albumen is a solution of lime-salts—97 per cent. water. With this we can imitate the production of bone, but the albumen becomes an almost indestructible substance. The fluid is so nearly neutral that a very little change will precipitate the lime-salts.

Dr. MILLS: To my understanding, the definition and explanation is quite plain as given by Dr. Atkinson in his lecture upon that subject (with which you are familiar, doubtless), and in addition to this we have so intelligently given us the structural condition of the human tooth by the honest and arduous labors of Dr. Bödecker, which "all may read as they run." I am aware that this subject has been battledored and shuttlecocked from year to year under the voluminous divisions of heat, redness, and swelling. And what are they? Inflammation is simply a process of combustion supported by the same laws that any combustion is, viz.: upon the elements that are provided in nature's laboratory. In the inflammatory action we are dealing with, it is supported by those elements formed *alone* in the living matter. The degree of burning, as manifested in the unbuilding of the structure, which we call decay, is developed in its intensity in proportion to the quantity of *perfectness* and *imperfectness*. So we have a poorly organized or soft structure taken down with greater rapidity than the opposite, and also varying degrees of *disease* or pain. In the prolongation of the track of inflammatory action, so manifestly exhibited in the drawing of Dr. Abbott before us, we have an analogy in a partly burnt piece of wood; starting from the black carbon and running out into the faded shade, indicating a carbonized condition of a less degree, produced by a less degree of heat at that point. Just here I cannot resist the temptation to insert the declaration that all building and unbuilding of the human tooth (or other tissues) is but a process of carbonization, differing but in degree; by this I mean calcification and recalcification is carbonization produced by this combustion or burning constantly going on in the

organization, supported by the play of excited elements upon the unexcited, arresting the direction of nature at her appointed time and place.

Dr. CROUSE: I did not expect to occupy any of the time of this Association on this subject, but the theory of Dr. Abbott and the views advanced by him are so at variance with my belief that I want to see who is so far in error.

If I understand him correctly he denies that nature does anything to prevent the decay of the teeth until the cavity is filled; that nature does nothing after decay commences to hinder or retard its progress. Is that your theory?

Dr. ABBOTT: In the great majority of cases.

Dr. MILLS: How would you answer the question as to what we call arrested decay, where there is no stopping at all?

Dr. CROUSE: That is a good question. I have seen—and every practitioner must have observed the same thing—instances where decay had destroyed a portion more or less of the tooth, and then the disintegration stopped, the surface became as hard as flint, the cavity was never filled, and there had been no treatment of the inflammation. The position of the tooth changed or the tooth adjoining was removed, or in some way the cavity was kept clean, so that acids could not form from the decomposition of vegetable matter, and food could not lodge. The saliva was allowed to flow there and wash away the acids, and nature arrested the decay. I have just such a case in my own mouth, where one-third of one of my lower bicuspids has been lost by decay. The tooth adjoining, which was also decayed broke away, thus destroying the receptacle for the lodgment of food and formation of acids, and nature stopped the decay. The tooth has been in this condition for fifteen years. I have seen the same thing where teeth have been separated, also where the patient took better care than formerly to keep the teeth clean, and nature did her part by throwing out ossific matter and arresting the decay. It is a part of nature's economy when an injury occurs in any part of the system to make an effort to arrest or repair it. And I had the idea that inflammation was one of the first processes to that end. According to Dr. Abbott, inflammation is the destructive agent in dental caries. If I understood him correctly he said, acid first destroys the enamel, and when the tubuli are reached inflammation sets in, and through this inflammatory process the tooth is destroyed, or at least he said the dissolution of the lime-salts was much more rapid on account of it. In any other portion

of the system, if the bones are injured, inflammation is the first restorative process. If a bone is broken, inflammation is the first thing that occurs, and I do not suppose we could have any uniting of the fractured parts without it. According to Dr. Abbott's theory, in case of a fractured bone we would be reduced to a mass of pulp in a very short time.

I think the same laws govern the entire system, and inflammation is not the cause or a part of the cause of dissolution of the lime-salts in our teeth, but is one of the means to restore or prevent destruction. If inflammation hastens or causes decay, why do teeth when the pulps are devitalized decay faster than those that have living pulps? Other things being equal, pulpless teeth decay faster than those with pulps, at least I have always supposed so; for the reason that in the case of pulpless teeth nature does nothing to arrest the ravages of decay, and in the other case the pulp throws out ossific matter and retards it.

Dr. Abbott: The gentleman evidently misunderstands my position. What I wish to be understood as saying is this, that it makes very little difference whether a tooth be filled, or kept free from acids or decomposing food in any other way, the result will be the same, a recalcification of that portion of the tooth which has been partially decalcified.

Dr. Crouse: You acknowledge that acid destroys the teeth?

Dr. Abbott: I acknowledge that acid is the primary cause of all caries of teeth, and that it is an important factor in its progress. It must be taken into consideration, however, that in a tooth there is something besides lime-salts to destroy and remove in the process of caries. In enamel there are three and a half parts in a hundred of organic matter, in dentine twenty-eight parts, and in cement about thirty-three parts. Now, can it be possible that this organic matter is dissolved away the same as the lime-salts? I should hardly suppose such to be the case, but a process of decomposition must take place in order that it may be removed and a cavity formed in the tooth. In order that this decomposition may take place, all the stages, from that of irritation up to that of death, must have occurred before decomposition could begin. In a dead tooth, as soon as the organic substance composing the matrix which holds the lime-salts becomes exposed, putrefaction *at once* begins. In the process of putrefaction of the organic portion, undoubtedly lactic acid is formed, which materially aids in dissolving the inorganic portion.

Dr. Crouse: Will a tooth without a pulp decay as fast or faster than a live one?

Dr. ABBOTT: Usually a little faster.

Dr. ATKINSON: Inflammation is a great stumbling-block when we talk about it or consider it in the old way. It is a burning, and there are two kinds of burning; eremacausis and burning in open fire. The first makes coke and charcoal in a smothered fire, and the other kind of burning frees water and carbonic acid, which pass away, leaving the mass of carbon as coal. When we understand this, that the oxygen combines with the hydrogen and goes off in flame or smoke and leaves the carbon exactly in the relation in which you see it in the coke or charcoal, combustion will be plain. If we desire to burn these entirely up and get an ash, we must have the supporter of combustion in abundance, which is oxygen, and then they are changed into carbonic acid gas and ashes. These are the products of complete combustion every time. The rapidity and slowness with which these changes occur, present us with the nourishment of the body and the destruction of the body, known as constructive and destructive assimilation. This process goes up and down the scale of molecular activity, which consists in a simple change of position of the molecules by reason of the calling for the energy resident in the atoms, which, when awakened and engaged, constructs the molecules and the tissues which are the elements of the organism. It is by reason of this change in the ultimate elements, and the relations they hold to each other, and the measure of engagement of these bonds that we get the basis of nutrient activities. If they are fully engaged, as long as they are guarded, it is a good match, and the family will go on very well. As to "decalcification and calcification," that is a mass of absurd nonsense. If we would say "liquefaction" and "resolidification" we would come nearer the mark of comprehending the changes involved. So far as the line of "resistance" is concerned, such as is displayed in the pulp-chamber opposite (that is, at the ends of the tubules whose periphery is included in the decayed spot) the cavity or abrasion, we shall have to relegate the explanation to the physiologist and pathologist, who alone can comprehend either the process or the instigator of the process by which the changes are effected. When all the changes involved in the building, nourishment, and repair or destruction of the tissues shall have been completely revealed, we may be entitled to do something much better than blubbering about mere mass-presentments of the *effects* of functional disturbances, such as talking and writing about "cones of resistance," just as if these mass-observations led the masses of our profession to the

comprehension of nutrient, de-nutrient or therapeutic modes, measures, or means.

Dr. WATERS: I wish particularly to address myself to those persons who do not see that both chemical and vital action are taking place here at the same time. The first effect of acid upon a tooth, it is easy to see, is a chemical one, a solution of lime-salts from the surface, thus impairing the integrity of the tooth before nature is aware of an attack, and, of course, before she is prepared to defend or restore the injured part. After awhile the invasion reaches a point where salts of lime in solution—a plastic or fluid condition —begin to satisfy the demands of the acid to a small extent, and then destruction of tooth-substance is, to that small extent, arrested. If the acid action continues, the demand for repair will after a while be felt on the inside of the tooth, and then through minute channels will come a flowing forward of plastic material to satisfy that demand. The first movement will be at the point of attack, and from that point inward until a current is set up, which, from its inception, begins to lessen the thickness of the walls of the channel by its own friction, and continued, renders the tooth more vascular, and eventually forms the "cone of repair." Here we have vital action cutting away the tooth to satisfy the chemical demands of acid. If now a portion of the tooth is cut off, so as to expose the surface of the tooth where the acid has been generated to the friction of food sliding over it, then nature stops the forward movement of the column of defense, and by repair closes up these channels; the surface ceases to be sensitive, and becomes harder and solider than before. More work can be done, as more nutriment can be carried forward; more lime-salts to neutralize the acids, which are destroying the outside. If a portion of the tooth is cut off so that the food slides over the surface and cleanses it, nature seals up these channels again, and the whole surface becomes harder and more solid than before, and I think you will all agree with that proposition. I think that is the simple fact of the case.

Dr. BROPHY: This matter in regard to the formation of secondary dentine is one in which I have been for some time deeply interested. I desire to speak of the pathological changes which I believe take place, and the efforts of nature to arrest them. The presence of an acid (most frequently lactic acid) in the fissures and surfaces of the teeth in contact with each other causes the enamel to disintegrate, and this disintegration, chemical change, or destruction of the integrity of the teeth, we term caries.

When caries has penetrated the enamel, inflammation of the organic matter within the tubuli of the dentine, owing to the contact of acids and other irritants, almost invariably follows, and it is then that a demand is made upon the system by the nerves that supply the parts, as if by telegraphic communication, for material with which to form a barrier to resist the invasion. Immediately the blood transports material and the tubuli begin to fill up, gradually converting the dentine into a solid mass. The advance of caries and the filling in of the tubuli occur simultaneously. Although the solidity of the dentine does not absolutely arrest decay, its advance is doubtless rendered less rapid.

The tubuli between the carious tissue and the pulp-chamber are finally completely filled with calcium salts in consequence of constant and prolonged irritation from without. When these tubuli are partially or completely filled, we have the cone or zone of resistance spoken of by Magitot.

The calcium salts continue to accumulate after the tubuli are filled, organize, invade the cavity of the pulp, and in some instances almost wholly fill it.

This formation is distinguished from the cone or zone of resistance by the name of secondary dentine. I believe dentine that has been softened or partially deprived of calcium salts by the action of acids, is not infrequently repaired by a new deposit of these salts.

The cone or zone of resistance and secondary dentine are produced by nature in its effort to protect the delicate and sensitive tissue of the pulp, and to prevent its exposure by the advance of decay. Caries usually, however, eventually finishes the work of destruction it has commenced, unless prevented by skillful treatment.

We all know that a large cavity in a tooth recently filled with metal is generally quite sensitive when subjected to thermal changes. In the course of time, however, not exceeding a few months, this sensitive feeling subsides, since the cone or zone of resistance has formed, and, sensation, therefore, is no longer as easily transmitted from the metal filling through the dentine to the pulp within.

Dr. Abbott: Why does not nature stop it (decay) before it commences? Or prevent it from commencing at all?

Dr. Brophy: Simply because the enamel is disorganized by the constant presence of acids. As soon as caries penetrates to the dentine, we have vital force brought into action to resist its progress.

Dr. Friedrichs: Why is not the whole tooth reproduced? One is as possible as the other.

Dr. BROPHY: I have not said, nor do I believe any portion of a tooth that has been destroyed and removed by caries is reproduced; but I do say that soft, partially decalcified dentine over which fillings have been placed *is* refilled with the salts of calcium, and restored to a density as much greater than the original normal dentine as the filling of the tubuli can make it. This hardness of the dentine, doubtless, has been observed by all after the removal of fillings. There is a character of caries which has not, I believe, been mentioned in this meeting. The cementum of the teeth, richly supplied with organic matter, is exposed by the recession of the gums. Here we have caries brought about by the action of an alkaline agent which removes the animal matter of the cementum and dentine beneath; after which the walls of calcium remaining rapidly disintegrate.

Dr. MOORE: I wanted to ask the eminent physiologist who has just spoken the cause of trouble in the teeth of certain classes of our people, which is of great importance. He spoke of decalcification or liquefaction of the dentine. What is the cause of the decalcification or liquefaction in the teeth of our Irish emigrants after they have been in this country a few years? We see the same thing among the negro population. Where the negro is confined to the plantation, and while he prepares his own diet in a simple manner, his teeth, in the majority of cases, are perfect. He has no need of the assistance of the dentist; but take him from the field, bring him to the house, subject him to the refining influence of civilization, and his teeth begin to show it in a remarkably short space of time. I should like to hear from these gentlemen the cause of this liquefaction in these particular cases.

Dr. PEIRCE: The inquiry raised by our friend, Dr. Moore, I deem of more than ordinary importance; it is one also of great interest, because it is based upon personal observation, and gives us a tangible clue to one of the causes resulting in the almost universal disintegration of tooth-tissue. A change of diet, a change in the manner of living, brings with it, not infrequently, a marked change in the durability of the teeth. Dr. Moore here gives us an example fully illustrating this in the negro transferred from the out-door work on a plantation where his plain fare, prepared by himself in his humble cabin, gives him food capable, from its coarse, dense, and dry nature, not only of keeping the teeth clean by its trituration, but also of stimulating the more highly organized soft structures to a degree of health and functional activity far exceeding that resulting

from the ordinary diet of the household domestic, where soft food and warm drinks furnish the larger part of the pabulum taken through the day. It is the old story, "absence of function, loss of capacity." This same thing is true with our domestic animals; deprive them for a length of time of food for which their masticating organs are adapted, and they lose the power of properly preparing that food for digestion and assimilation. Go with that indefatigable worker, Henry Bergh, to the stables of the slop-fed cows of this city, and you will sicken at the shocking, loathsome sight there presented. Cows, whose milk is sold for the nourishment of thousands of children in this city, are toothless, gumless; the oral cavity, instead of evidences of health, giving forth filth and offense from absence of function, loss of capacity, and deficiency of nutrition. The preparation of soft food, the habit of washing it into the stomach without trituration, together with the concomitant evils that follow, is certainly, in the human family, one of the most prolific sources of dental caries.

I think Dr. Abbott must certainly have misrepresented himself when he stated that molecular disintegration of the hard tissues of the tooth may go on to the "liquefaction of the lime-salts," an actual breaking up of the continuity, of the organic and inorganic part of the tooth; and yet by filling up the cavity with these broken-down mineral organic portions within, that the continuity is re-established, density and health-normality regained. I cannot believe it. Broken-down lime-salts, as well as the disintegrated organic matter, may remain in the cavity and serve as some protection to the living tissue beneath, but that their continuity and vitality are re-established without going through the digestive and assimilative process is certainly very questionable.

Dr. Abbott stated in his remarks yesterday "that he had never found bacteria in the cavity of decay." The presence or absence of bacteria depends, it is supposed, upon a putrefying fermentation; fermentation may go on to the formation of a destructive acid without necessarily resulting in putrefaction, but if, under the influence of heat, moisture, and confinement, putrefaction does occur, then most surely bacteria will be found present.

The popular theory respecting the influence of leptothrix upon tooth-structure is doubtless incorrect, and is the result, it seems to me, of a limited knowledge concerning its germination, pabulum, habitat, etc. True, it is found in cavities of decay, but not in greater profusion nor more prolific in those where decay is rapidly progressing, than where disintegration has been entirely arrested, on the

tartar, or between the teeth, or on the tongue, where it grows most vigorously from the desquamated epithelial cells; indeed, wherever there is disintegrating organic matter of either vegetable or animal origin, it is found in profusion, provided moisture, heat, and atmosphere are favorable. Its influence is certainly benign; in its consumption of dead matter its tendency is to render acid secretions alkaline. In fermentation we have another vegetable growth, the *cryptococcus cerevisiæ*, a little cell or capsule. In its development and multiplication sugar is consumed and an acid is the result. To this little cell we are indebted for our vegetable acids, which are the result of fermentation, and also for the acids of the oral cavity, which are so destructive to the dental tissues.

Dr. TAFT: The statement has been repeatedly made in this discussion, that after decalcification resulting from decay of the tooth, the residue assumes, or is in an embryonic condition; just what is meant by that expression is not clear to me.

Is it that this residue possesses the form and condition of the developing body or organ? And, if so, at what period of the embryonic development? For it must be remembered that this process is a progressive one; each period exhibiting aspects and conditions peculiar to itself. Now, which of these aspects and conditions is promoted by the residuum of dental decay?

The propriety of this nomination is certainly not warranted without further evidence than the bare statement of any one individual. Is it claimed that this residue has within it all the elementary substances that go to make up the embryo? I think no one will, without qualification, make such an assertion. Or is it affirmed that the structural character of this residue is like that of the embryo? If so, in what respect? The residuum in tooth-decay varies exceedingly in different cases in the retention of its structure. In some it is wholly destroyed; in others it is retained in a remarkable degree of completeness, and there is every degree of presentation between these extremes. It is true that in decay of the teeth the order of the disintegration is, in one aspect, the reverse of its upbuilding; in the latter process the introduction and fixing of the calcareous constituents is the conclusion of the work; while in the former the removal of the inorganic part occurs early, if not at the beginning of the process.

Reference has been made to what seems, on the diagrams presented here, to be a cavity wholly surrounded by solid dentine—not having connection with the surface nor any other cavity of decay. The

impression made, on some at least, was that this was an evidence of internal decay, or might be. Now, it must be remembered that this presentation in the diagram is only that shown by a thin section—what relation it sustains to the structure at either side of it is not shown. I am not aware that the existence of internal decay of the teeth has anywhere been proved, or that it has been made to appear even probable.

The impression first made is somewhat modified by the admission of Prof. Abbott that this seemingly inclosed cavity might have had connection with some other cavity. This apparent opening, which must have been very small in the tooth, may have been the result of arrested or defective development at that point. Such defects often exist; they are found in both the enamel and the dentine.

The discussion, thus far, would lead us to the conclusion that decay is produced by free acid that may have been in the mouth for some time before its attack upon the teeth. This view I regard as incorrect. The agents that produce the disintegration of dentine in decay are usually found at the time and at the point of attack, and work with the energy of the nascent state. This, if correct, has a practical bearing in this respect: that much reliance cannot be placed upon the topical use of antacids for the arrest or retarding of decay.

Indeed, the mouth, as a whole, may exhibit an alkaline condition and still decay be going on rapidly, and this can only be accounted for upon the theory that the disintegrating agent is formed at the time and point of its action upon the tooth-substance.

Dr. Abbott: I would state, in correcting the apparent misapprehension of Dr. Taft, that if he understood me to say that any such appearance as this indicates here, could be found in the body of the tooth without any connection with the decayed surface at all, he made a great mistake. I never dreamed of such a thing, never said it, but said as positively as I could, not only yesterday, but to-day, it is simply a liquefaction, which Dr. Atkinson has stated is a better term to use, and re-solidification. That liquefaction takes place from inflammation that occurs, and is not due to any acid at all.

Dr. Crouse: He has just made the remark that it was acid and inflammation. Before he said it was inflammation that produced the acid condition. Is it acid in there that does it, or inflammation?

Dr. Abbott: How queer some people will be. I say decay begins upon the surface of the tooth by the action of an acid; that the

lime-salts, as far as they are carried off, are dissolved by acid which is produced probably at this point; that the moment living matter becomes exposed we have an irritation set up, which penetrates the living matter of the tooth some distance, and is sufficient to liquefy the glue-giving basis-substance.

Dr. CROUSE: You said the inflammation did not do it.

Dr. TAFT: Dr Crouse's question is a pertinent one. I hold that inflammation, *per se*, cannot liquefy a calcareous salt. Then, if the inflammation does not do it, what does it? If it is acid, whence does it come? It is a pertinent question, and the gentleman ought to have answered it, and answered it squarely; as he told us yesterday he would discuss this subject, and if anybody had any questions he would answer them—a bold proposition, but perhaps the doctor is equal to the emergency.

Dr. ATKINSON: Gentlemen are bound to listen. I assert that he did not say that the acid dissolved the portion external, but if it penetrated the living matter, by the irritation the inflammation was set up.

DISCUSSIONS ON ABRASION.

Dr. CHANDLER: I had the pleasure of listening to Dr. Davenport's paper last night. As far as it went it seemed to me very excellent, but he seems to be on the wrong track when he calls the work of mineral acids spontaneous abrasion. He referred to Dr. Harris's account of this trouble, but gave a different reason for it by referring it entirely to the breathing-in of acids, and not, as Dr. Harris says, to an acid mucus, produced by the mucous follicles at the end of the tongue. I do not take much stock in Dr. Harris's explanation, and I think Dr. Davenport has not hit Harris's idea. I have among my patients two gentlemen who have the same affection spoken of by Dr. Davenport. They are in the manufacture of acids; the largest manufacturers in New England. They are brothers. When young men, their father put them into the acid factory to learn the business, so that they might know every step of it. Their teeth were affected very much in the manner Dr. Davenport describes, but it is not Harris's abrasion. The form his abrasion takes is a double curve on the ends of the front teeth of both jaws. They would be otherwise normally shaped. In these cases, however, the acid has not chipped off the ends, but has taken away from the labial surfaces, most at the ends, and diminishing as we approach the gum in a curve.

This will be the shape of the tooth after it has been eaten by acids. That process goes on in the same way until, by and by, there is no tooth left. Harris's figure is a different thing. Harris's takes this form: Here is a furrow down in the center of the front teeth; every center ridged in this way. The upper teeth are the worst. (This was illustrated by drawing on the blackboard.) Harris speaks of the cause of his abrasion, but I will not venture to say if he is right or not. I have also two patients who have that form of abrasion. One is a clergyman who never saw the inside of an acid manufactory; who has nothing to do with acids, except sharp things he has to say with his tongue. Another is a bank cashier, who is not in the habit of eating pickles; who is not in the habit of sucking acid fruits nor drinking lemonade. They eschew acids of all sorts. The trouble has gone on in both increasingly for the last five years. It is chiefly in the four front teeth. The canines do not seem to be affected; but wherever you find this trouble on the front teeth, you will find a similar trouble on the molars and bicuspids. The molars are often hollowed out. They are eaten out as though by acid. The center of the cusps is hollowed like a cup. Wherever you find this abrasion of Harris's, you will find this condition of things in the molars and also the bicuspids, but not so marked. I have noticed it a good many times, but these two cases are the worst I have ever seen. I cannot account for it. It is evidently the work of some acid. Where the acid comes from I cannot say, but the destruction is on the ends of the teeth entirely, and not on the front, as in the cases Dr. D. speaks of. The gums are not affected. The line of the arch above the enamel does not seem to be troubled, but the mischief is on the ends of the front teeth, and on the ends of the molars. There seem to be several kinds of affections which are counted abrasions. This kind is probably spontaneous abrasion, if there is any such thing, and is due to a solution by acid, and that acid of oral formation and not from without.

Dr. Atkinson: When we talk of spontaneous abrasion, I should like to have anyone define what the spontaneity is. I hold that all the functions of the body are spontaneous action of the part that operates the activities of organized beings; and, if we talk in that general sense, I have no objection, but to say spontaneity will operate in a certain locality of itself, and at this one location, I am in doubt as to holding any views about it whatever. The cases referred to here and in Harris are not very uncommon. I have seen a number of them in my life, but I have seen something that is even

more ambiguous than this. I have seen S-shaped excavations cut in clear across the entire surfaces of the tooth on the buccal, and around the proximal on to the lingual wall, and this wall entirely sound, and these excavated surfaces as polished as in the best examples in nature. I have seen it in a number of cases on bicuspids, molars, and cuspids, but never on incisors. I have seen the form Prof. Chandler speaks of a number of times, but as to knowing anything about the cause I do not pretend to. But the surface is so handsomely polished that I have desired some means by which I could finish disintegrated enamel as well as these are done, and get as fine an appearance. Where this has interfered with speech and mastication, I have resorted to filling up these furrows temporarily, and so got encouraged to put gold in, and build out to contour. In the great majority of instances this has been successful. In a few instances disintegration has gone on at the margin of the gold, and required a secondary operation. I never had it recur after the second effort to arrest the trouble. As to the antecedents which lead to this possibility in tooth-structure to take a special kind of limit to decay, I have speculated a great deal. I have seen this, probably, more frequently at the margin of the gums than at any other place, and at such places as a tooth-brush could not reach, and on the lingual border of the gum on bicuspids and molars and canines. In the other form there is simply chemical solution, and we have abundant proof of this in the attendants upon acid factories, as has been referred to. Do we know that acid does it at all? I should rather say a disintegrant, and use some other term that suggests a breaking down of the structure itself, than to confine myself to saying it must necessarily be an acid. I should prefer the term solvent or disintegrant, for I feel we are very far from scientific accuracy, when we so blindly assert that it is always an acid that produces it. What are my reasons? That in a great many instances there was no possibility of detecting acid.

Dr. Barrett: I have no special theory to offer, but desire simply to say, that at the present time I have two patients as unlike as they well could be, and the teeth of both are affected in this way. One is a young, the other an old lady. One is healthy, hardy, robust; the other pale, weak, anæmic. One has light hair and a nervous temperament; the other is dark and bilious. The secretions of the mouth of one are distinctly and strongly acid; of the other almost as distinctly alkaline. Ordinarily I have cut out all such places and filled them. In one of these instances I did so, but as the other

lady is a well-known vocalist, I have hesitated about the matter, because of the conspicuousness of such fillings. I have applied every remedy that suggested itself to my mind in vain. Filling has usually been a cure for this abrasion, and my opinion is, that to this the case over which I have long hesitated must eventually come; but I shall put off the evil day as long as possible.

Dr. LITCH: Whatever may be the truth with regard to other forms of destructive metamorphosis in tooth-tissue, that form known as erosion seems unquestionably to require a vital condition of tooth-structure for its development. I have never seen a fully characteristic case of erosion in a devitalized tooth. The smooth and polished appearance of an eroded surface is not characteristic of a simple acid reaction on lime-salts; a non-vital surface eroded by acids is always roughened. Acid secretions may be an exciting cause of erosion, but, in my judgment, the vital force of the living matter in tooth-substance is an essential factor in the production of the lesion in question. Erosion may, perhaps, well be denominated an atrophy induced by some as yet undetermined cause or causes.

Dr. CUSHING: Dr. Litch's remarks lead me to relate an instance of a very marked corroboration of his statement, that dead teeth rarely, perhaps never, present that condition. In the mouth of a patient of mine, every tooth, from the second bicuspid on one side to the second bicuspid on the other, is affected in that way, except a central incisor which is devitalized. That is not affected at all. All the others are to a very great extent; the cuspid tooth on the right side to fully one-third of its diameter; the other cuspid not so much. That is a very strong corroborative instance, as both living teeth and a dead tooth are present in the same mouth.

Dr. FUNDENBERG: A patient who has been under my father's care for many years, and who had his teeth placed in perfect order some two years ago, presented himself at our office about one year afterwards, complaining of a great sensitiveness near the necks of the teeth. Upon careful examination it was discovered that this "breaking down" of tooth-structure had occurred upon the labial, palatal, mesial, and buccal surfaces of every tooth in the upper jaw, with the exception, I believe, of the two central incisors. There was very little destruction of tooth-structure that was not beneath the gum. It had extended so far that several of the teeth were almost lost by it, and this all appears to have taken place within the space of one year's time. I do not know how to account for it. The cavities were prepared, being quite sensitive, and were filled

with plastic fillings; since which time I have not seen the patient.

Dr. BROCKWAY: What was the condition of his health?

Dr. FUNDENBERG: Good health; strong, robust; about sixty years of age; Scotch descent, and had never dealt in acids.

Dr. BARRETT: Any urinary difficulty?

Dr. FUNDENBERG: No urinary difficulty that I am aware of.

Dr. BROCKWAY: The cases just mentioned very nearly correspond with one which came into my hands about nine years ago. A young man presented himself for examination, having apparently perfect teeth. At the first glance I was inclined to say that they required no operation, but upon closer observation, I was surprised to find this condition of "grooving" around the necks of the teeth which has been referred to, partly concealed by the gum, and in most cases more than half encircling the tooth. All the teeth of the upper jaw except the molars, and all of the lower except the molars and second bicuspids were thus affected. The trouble was evidently of recent development.

I questioned the gentleman as to his health, which he assured me had always been good, but presently correcting himself, said that he thought he had felt some trouble with his kidneys of late.

I sent him to a physician in whom I had confidence, who upon examination confirmed his suspicions and successfully treated him for his ailment. When this had been done, I filled with gold all the affected teeth. I saw him occasionally afterwards for some two years or more, and during this time there had been no recurrence of the trouble. Since then I have lost sight of him.

Dr. WATERS: A year ago last October, a sea-captain came to my office to have his mouth attended to. He had that condition of the teeth described by the gentleman from Pittsburg, where decay had taken place beneath the gums. The crowns of the teeth (many of them) appeared very healthy. Some were badly decayed, some entirely gone, and in this case the decay had taken place beneath the gum, and the crowns broken off. During the time I was operating, he had some trouble with an inflamed pulp or two, for which I had to use a good deal of treatment, but in these teeth there was not this trouble of decay under the gums that I have mentioned. He said he never had been confined to his bed in his life, but that he had several times been troubled with his kidneys, and was so at that time. He could not remain in the chair an hour at a time, consequently it was difficult for me to operate with gold, and I concluded that, under the circumstances, perhaps it would be just as well

to use plastic filling; and I selected oxyphosphate. The man I also learned had a trouble with his liver; but whether this trouble of the kidney and liver had anything to do with this condition of the teeth, I do not know. He was an inveterate tobacco chewer and smoker.

DISCUSSIONS ON ANESTHESIA.

Dr. BARRETT: Last year I read a paper before this Association upon anesthetics and anesthesia. I then declared my purpose to continue this line of experiments, and made a half pledge to present at this time another paper having for its special subject nitrous oxide gas. I never worked harder than in the attempted fulfillment of this partial promise. In my note-books are complete records of about one hundred and fifty experiments and vivisections in the line of this research. It was but very recently that I finished them, and when I was through, what with these studies, my professional duties, and some other labors which had burthened me, I found myself utterly fagged out. It seemed that my brain was exhausted; my pond was dry, and the more I pumped and pumped at it the more roily and unsatisfactory was the product. When I had finished a paper of respectable length I found upon looking it over that it was quite unworthy to be presented here. I was ashamed of it and resolved to throw it away, confess my inability to properly collate the results of my labors, and ask your indulgence. I have the data still in my note-books, and perhaps at some time may be able to dig something out of them. But at this meeting I am forced to appear before you under the shadow of an unredeemed pledge, and will endeavor to make such present atonement as a few extemporaneous remarks may carry.

Notwithstanding the early introduction of nitrous oxide gas, its extended use and careless mode of administration, it is an undeniable fact that deaths from its exhibition are much less frequent than from any other anesthetic. Do we fully comprehend the extent of this immunity? I have not the statistics at hand to verify my statement, but I believe that despite the almost exclusive use of other agents in all the great hospitals nitrous oxide is the most widely employed of all the drugs which produce narcosis. It is also administered to the widest range of persons so far as physical condition is concerned. There are many people suffering certain forms of diseases to whom the most reckless of practitioners would not give chloroform or ether, but to whom nitrous oxide is freely

administered. To many dentists there is absolutely no physical condition which positively forbids their administering this gas. Then, too, it is used by perhaps the most ignorant and stupid class of persons that can be found among our people, for if there be any set of men more recklessly obtuse and more dangerously unenlightened than is the average cross-roads dentist, I do not know where they are to be found. Yet these men are extensive employers of nitrous oxide. Chloroform and ether are in the hands of better educated men. They are mainly employed by men of medical training, and the people at large have too wholesome a dread of their danger, and are too well informed concerning their properties, to intrust their use upon themselves or their friends to a dentist who has just as much knowledge of materia medica and therapeutics as the manufacture of rubber dentures teaches. But all these men are making and administering nitrous oxide, impartially to friend and foe, young and old, strong and weak. It is in fact the especial refuge of the quack. You and I know, Mr. President, that when we look upon the brand-new, gilt-edged sign of a dentist who flauntingly offers to extract teeth without pain or danger, that he keeps one of those dental butcher shops where nitrous oxide is widely employed. When we see some boastful advertisement in the newspapers promising that Dr. Blank extracts teeth in a positively delightful manner and without the slightest risk, we recognize the trail of the same old serpent. It is nitrous oxide, and every experienced practitioner knows both these men for the worst of charlatans. Sometimes Dr. Quack endeavors to cover up the matter by claiming a new discovery and calling it "Vitalized Air," but we know that it is still nitrous oxide, and that the advertiser is one step lower than the average pretender, for he is not alone an ignorant, but a dishonest and vicious quack as well. Despite their ignorance and recklessness these fellows manage to get along with comparatively few accidents. Chloroform and ether are administered by thoroughly qualified, well-educated physicians, and yet their death roll is a very respectable one. Nitrous oxide is used by the opposite class, and there seems a comparative immunity in its administration. How shall this be accounted for, Gentlemen? We cannot shut our eyes to the fact; we cannot ignore it; it will not down at our bidding. Is it not rather important that we examine into the physiology of it and learn whence comes this apparent harmlessness? Ought we not to examine whether it be real, and, if so, whether the present harmlessness be offset by future complications and perils?

There are a number of theories by which to account for the narcosis produced by anesthetic agents. One is that it is due to a want of oxygen in the tissues. It seems to me quite sufficient answer to this to show that the insensibility produced by asphyxia is quite distinct from anesthesia. The symptoms, the progress, and the phenomena of the two conditions are quite unlike, and the post-mortem appearances show a wide divergence, so that there is no necessity for any further expenditure of time in this direction. Again, it has been held by some that anesthesia is due to hyperoxygenation. That this cannot be true in the exhibition of chloroform and ether is amply proved by the fact that the supply of oxygen is very much lessened, while the amount of carbonic acid eliminated is decreased. Nitrous oxide presents the same phenomena and the theory therefore does not hold good with that agent. Another hypothesis is that narcosis is due to interference with neural nutrition, but an examination of the tissues, the rate of its progression, as well as its incompatibility with well-known physiological laws, forbids our acceptance of this theory. It is also argued that narcosis is due to certain specific qualities which inhere in the agents; that anesthetics have the potentiality to dominate nervous impulses, that it is their special office to so paralyze nervous tissue as to make it impossible for it to perform its functions, and that this obtunding of all nervous sensibility up to a given point, this locking of the tissues of the voluntary system in oblivion, we call anesthesia. To me this seems the only reasonable way of accounting for the phenomena; and the special symptoms accompanying each separate agent are due to some properties perhaps aside from those which induce unconsciousness. But all anesthetics have this in common: they paralyze nervous tissues according to a definite rule, the progress of the insensibility always being from the periphery towards the nerve-centers. That the effect of some agents is more quickly produced than that of others, and that in some it is evanescent and weak, while in others it is profound and lasting, is due to peculiar qualities of the agent aside from its anesthetic properties. But there are certain phenomena in the progress of the narcosis which are common to all anesthetics, but which are quite distinct from those produced by agents which simply bring about asphyxia; as, for instance, a regular graduated rate of progression in the tissues; certain peculiarly marked stages of nervous disturbance, and the character of the spasms which sometimes accompany their employment. It seems to me that these are so distinctly marked that

there need be no necessity for the confounding of the one with the other. I am supposed now to be particularly considering the anesthetic qualities of nitrous oxide gas. All my experiments and observations lead me to the inevitable conclusion that it does not essentially differ from ether or chloroform, the other best known anesthetics, in its actions and effects, and that it truly belongs to the same class. I am aware that in saying this I antagonize well-known authorities who do not consider it an anesthetic at all, but I am sure that full consideration of all its qualities will convince most people that its peculiar effects, while partaking of the same character as those of the other agents, are produced in the same manner. Its apparent harmlessness is due to its weak toxicological power.

In the administration of all anesthetics it is necessary that sufficient of the agent be in existence in the blood at one time to produce characteristic effects. The blood is the agent in distributing it to the tissues, and while a certain amount of even the most powerful agents may exist in that fluid with entire impunity, if the proportion be increased beyond a certain limit the characteristic effects are soon manifest. An atmosphere containing one or two per cent. of chloroform is insufficient to induce narcosis; but five per cent. will slowly produce insensibility, while twelve per cent. causes the patient to quickly succumb, too often with alarming symptoms. The potentiality of ether is not quite so great, but does not widely differ. That is, a person may inhale an atmosphere containing a definite amount of ether, chloroform, nitrous oxide, bromide of ethyl, carbonic acid, carbonic oxide, or chlorine gas without being materially affected by them, but if this proportion be exceeded, and thus sufficient of either agent be introduced through the pulmonary surfaces into the blood and be thus existent there at one time, its characteristic effect is produced upon the tissues. This proportion widely differs with the agents used, but there is a certain line which cannot be overstepped with impunity if we wish to avoid pathological changes. Some of these agents produce but a feeble impression, from which the patient soon recovers. Others exert so profound an influence that when once their power is fully manifested recovery is doubtful and slow. Thus there is a wide distance between carbonic acid and carbonic oxide (CO_2 and CO). So there is a great gap between nitrous oxide and chlorine gas. Of the one large proportions mixed with common air can be breathed without any perceptible effect; of the other a comparatively small admixture is fatal. Now,

my theory and belief regarding nitrous oxide is that it is potentially weak, and therefore we find it necessary to as quickly as possible overwhelm the whole system by introducing into the blood as much as possible in a given time. In administering it, therefore, we cut off the entire supply of air, and let the patient breathe the gas exclusively; at the same time we urge him to rapid and deep inhalations that we may introduce the greater quantity of it into the blood before elimination commences. We reach the point of insensibility as soon as possible, because we know that in a definite time the breathing of the gas must be suspended that asphyxia may be avoided. All who have had experience with this agent are aware that unless the patient quickly passes under its influence alarming symptoms supervene. The lips and features become blue and purple; the pupil of the eye expands, and clonic spasms threaten. In fact, the patient is becoming asphyxiated for want of the oxygen which has been entirely cut off. A person will breathe nitrous oxide exclusively just as long and no longer than he can carbonic acid gas. The contrary has been asserted, but, Mr. President and Gentlemen, I have experimented too long and too exhaustively in this direction to be easily mistaken. In an atmosphere of pure nitrous oxide gas and one of pure carbonic acid I have a great many times demonstrated that animals live the same time and die about simultaneously, the only marked difference being that, in the first, anesthesia is primarily induced, and during the subsequent symptoms of asphyxia the animal is unconscious.

I had proposed to demonstrate these points by vivisection, to be performed before this body; experiments entirely painless of themselves to the animals used, and had the meeting been called anywhere but in New York I would have tried to be prepared; but here you have one man, Mr. Bergh, who, actuated by some unaccountable impulse, has planted his attenuated form directly in the path of progress, and has attempted to stay the exploration of physiological subjects. I judge no man's intentions and impugn no man's motives, but it does seem to me that nothing but the densest ignorance of the methods of carrying on physiological investigation could induce any one to make the assertion which Mr. Bergh has made. Whether it be from a kind of morbid vanity which impels him to the most absurd actions that his name may be aired in the newspapers, or whether it be from a mistaken or from a natural sympathy with the lower orders of animals, certain it is that through special legislation which he has procured and through the wresting of the law from its natural

interpretation, no sooner does a man attempt to save his fellow-man from misery and danger by the interposition of the life of some worthless cur-dog which it is an act of mercy to destroy, than Mr. Bergh through his paid agents interferes and plainly demonstrates with whom his sympathies reside, and with which order of beings he desires to be classed. I am, therefore, debarred from demonstrating these statements before you this year, and you must accept my statement that I have many times before dental and medical societies, in the presence of learned professors and skilled physiologists, in all the various methods practicable, and after the most careful study to eliminate every source of possible error, again and again and again proved that nitrous oxide will asphyxiate as certainly and as quickly, when all sources of oxygen supply have been cut off, as will carbonic acid. I have tried to make an exhaustive study of the comparative effects of these two gases that I might clearly to myself differentiate their symptoms. I have two large glass jars covered with ground glass cones with two holes in each for the introduction of the fresh and the escape of the used gas. They are of the same size and shape. One of them has been filled with carbonic acid gas and the other with nitrous oxide. After each was thoroughly tested I have introduced two rabbits of the same litter or two pigeons of the same brood, or two rats of the same size, or two cats, or two dogs as nearly alike as could be procured, one into each jar. The tubes from the carbonic acid generator and from the nitrous oxide tank were then introduced into their respective jars, and a steady stream of fresh gas conducted to the bottom that no claim could be made that a contaminated gas was employed. The gases used have been of my own manufacture or that of some friend, and in addition I have procured and used repeatedly the liquid nitrous oxide and liquid carbonic acid furnished by Johnston Brothers, of this city. And now for results. There never has been any material difference in the time of death of the animals; sometimes one, sometimes the other gas seemed by a few seconds to be most quickly fatal. In the nitrous oxide, narcosis supervened usually in from one to two and one-half minutes, with a contraction of the iris. No narcosis existed at that time in the animal confined in the carbonic acid, but the iris was gradually expanded. From this time on the symptoms are usually about identical, the iris of the anesthetized animal commencing to dilate, and finally both die with nearly the same attendant symptoms. Post-mortem appearances were, however, widely variant. The blood and tissues of the animal which

had breathed carbonic acid gas were dark in color and the heart was engorged. The tissues of the other animal were generally light in color, the heart was completely clear, but the brain was engorged—the ventricles sometimes containing extravasated blood. The light color of the blood for a time led me astray, and I believed or at least suspected it to be due to oxygenation; subsequent experiments, however, convinced me that I was in error in this suspicion. Nitrous oxide is exceedingly soluble in the blood, and it unites with it, causing the change in color. But it unites as NO and not as dissociated elements. Carbonic oxide also unites with the blood and changes its color somewhat. Nitrogen dioxide unites yet more freely than the monoxide. That nitrous oxide can for a moment sustain respiration I think I have exhaustively disproved, but air when very largely diluted with it will sustain life for a long time. In nitrous oxide the two elements have united and formed an entirely new substance, and before it could by any possibility exercise an influence in sustaining respiration its decomposition must take place. One might as well say that nitrogen dioxide would sustain life as to affirm it of the monoxide unless it can be proved that it is more readily decomposed. Now, if a lighted match be introduced into a jar of nitrous oxide the combustion becomes almost as brilliant as in oxygen. But in this case the heat is sufficient for the breaking up of the compound and the setting free of the oxygen. All the nitrogen compounds are unstable, and this is no exception, but it requires a definite force to dissociate the atoms, and abundant experiment proves that the heat of the body is insufficient for this purpose.

I wish I could demonstrate these things before you, but it is now beyond my power. You can, however, try experiments for yourselves. But if you are about to commence such a course let me warn you of a few things. You will sometimes get most contradictory results, and it will require long patience on your part to deduce a constant law. There are so many sources of error, especially to the beginner in experimental sciences, that it requires long experience to at once detect them. Remember that one swallow does not make a summer, nor one experiment overthrow long established laws. I well remember when after my apparatus was completed I invited a learned professor of chemistry in a well-known medical college to witness my first demonstration. Pigeons were introduced into each jar. In the nitrous oxide, to my surprise, the pigeon was dead in less than three minutes, while in the carbonic acid the other lived sixteen minutes. I afterwards found out that

the probable cause was due to pathological conditions of my animals, but the professor was very much astonished, and declared that his whole science was at fault, as he had confidently predicted a contrary result. In experimenting with birds their peculiar anatomy must not be lost sight of. They have supplementary abdominal air reservoirs, and before you are certain that these may not affect the result it may he necessary to anesthetize them, insert a tube in the trachea, inflate the lungs and these reservoirs, that they may readily be found, and then, raising the point of the sternum, enter the abdomen and rupture these membranous sacs. The birds may then be left to breathe through the abdomen, and this source of error will be avoided. Let no student set out with a favorite theory which he desires to prove, or anything which he wishes to disprove. Let him seek for truth and be prepared to recognize her in whatever garb or unwelcome form she may present herself. Every student should also make careful post-mortem examinations of animals destroyed that he may see the effects of his experiments upon particular tissues.

Dr. Buckingham: I wish to ask whether Dr. Barrett has observed that nitrous oxide gas has any specific action upon one organ as distinct from the rest.

Dr. Barrett: I am inclined to think that when an animal or a man dies from the direct influence of the gas, it is from blood-tension in the brain. I have seen but few such cases and usually there were present all the symptoms of apoplexy, and in some animals dead under such circumstances I have found extravasated blood in the ventricles of the brain. In the profound state of full and quiet anesthesia the brain is usually anæmic, but during the excitement-stages of narcosis it is hyperæmic, and this in all anesthetics is the dangerous period. If this excitement-stage in nitrous oxide should pass away and the brain become relieved of its pressure, I should not expect danger, but should for some reason the blood-tension be increased the gravest consequences might ensue.

Dr. Meigs: I understand that Dr. Sims kept a lady under the influence of nitrous oxide for one hour and fifty-nine minutes, and I believe that Mr. Johnston told me that he had known several cases in which the influence was continued for from forty-five to forty-eight minutes.

Dr. Barrett: I have kept a patient in a surgical operation under its influence for thirty-seven minutes. It was done by carefully watching the case, and as soon as symptoms of asphyxia were manifest, air

was admitted until they passed off and recovery was imminent, when the gas was again applied. But there were times when consciousness was nearly complete, and only for a very perfect control over the patient, she could not have been kept upon the table.

Dr. MEIGS: I should like to ask another question, regarding the capacity of different persons for taking gas. And, while I am on my feet, I will say that I saw a patient who required so much gas that it was necessary to keep the valve wide open, and I marveled greatly at the quantity which she consumed, which must have been from thirty to forty gallons, although no bad results followed.

Dr. BARRETT: Many persons have almost entire immunity from the effects of particular drugs. Some people will get drunk upon a teaspoonful of whisky, while others will drink a pint. It is owing to some peculiar physiological condition or to some extraneous influence, and aside from that which inheres in the drug itself. It is a peculiar idiosyncrasy.

Dr. LITCH: I am very hopeful that the investigations of Dr. Barrett may throw light on this obscure and interesting subject. In his remarks he takes what I judge to be the right view of the physiology of nitrous oxide gas, namely: that anesthesia from this agent is a specific effect upon the nervous system, and that it is not due, as has been suggested, either to hyperoxygenation or to carbonic acid gas poisoning. It is, perhaps, not a very clear definition of the effect of nitrous oxide gas to say it is specific, but it at least eliminates an erroneous hypothesis. There is no question at all that nitrous oxide, N_2O, is as distinct a chemical compound as water, H_2O. One can be almost as readily decomposed as the other; nitrous oxide by the action of heat, water by the action either of heat or of the voltaic battery. The amount of heat necessary, as stated by Dr. Barrett, to decompose nitrous oxide, far exceeds the normal temperature of the body. It requires a red heat. This gas will not ignite an organic substance until it is at a temperature of perhaps one or two thousand.

Hence the fallacy of the idea, first advanced, I believe, by Dr. Colton, that anesthesia from nitrous oxide is really a condition of hyperoxygenation, the N_2O being decomposed in the lungs or blood and free oxygen thus obtained. The temperature which would decompose nitrous oxide would destroy all animal organisms. Moreover, it has been found that after N_2O has been breathed into the lungs, and has produced its full anesthetic effect, it is eliminated from the lungs unchanged still N_2O. In the interesting experi-

ments made some years ago by Dr. Evans, of Paris, this fact was fully demonstrated. He passed into the lungs a measured volume of the gas, and passed into a receiver all the products of expiration, from the beginning of the administration of the nitrous oxide to its end. He found the nitrous oxide to come from the lungs unchanged in its chemical structure, and that about three quarts remained in solution in the blood at the time of complete anesthesia.

That anesthesia from nitrous oxide is not carbonic acid gas poisoning is proved by the facts that the nitrous oxide does not contain the carbon element, and that the characteristic effects of the two compounds are quite dissimilar in many important particulars. That the patient may be asphyxiated by nitrous oxide is unquestionable, just as he may be asphyxiated by ether or chloroform or opium, through arrest of the respiratory functions; but in each case he is asphyxiated because he is narcotized; he is not narcotized because he is asphyxiated. In each case the effect is a specific one with well-marked characteristics, differing with the agents employed.

Dr. Barrett attributes to a weak potentiality the safety which attaches to the use of nitrous oxide. In this, although I am not disposed to be dogmatic upon the point, I think that he is a little in error. Neither ether nor chloroform, even when their pure vapor is inhaled, produces complete anesthesia in so short a time as nitrous oxide. With nitrous oxide complete anesthesia comes on with what corresponds to the second of the three stages of etherization, namely: the stage of tetanic muscular contraction, this being followed in ether and chloroform narcosis by the stage of complete general muscular relaxation, a condition which cannot be safely attained with nitrous oxide, although we often, indeed generally, have this condition of muscular relaxation produced in the muscles of the tongue and fauces, as evidenced by the stertorous respiration which usually marks the stage of complete anesthesia in nitrous oxide narcosis. An average of over six minutes of time is required to produce complete anesthesia with chloroform, and an average of over eight minutes with ether. That agent can hardly be said to be weak in potentiality which produces, as does nitrous oxide gas, complete anesthesia in less than one minute.

It is true that when its exhibition is discontinued, consciousness and sensation are restored as rapidly as they have been lost; but this is due not to its weak potentiality in, but to its rapid elimination from, the system. If duration of the anesthetic effect be taken as the index of potentiality, then alcohol is the most potent of all

anesthetics, for alcohol narcosis with its profound anesthesia will often last for hours. This, indeed, is the anesthetic preferred and recommended by Dr. John Lynk for all surgical operations, he giving to an adult about a pint, in tablespoonful doses, twenty minutes apart. The patient simply becomes "dead drunk" and completely anesthetized, in which condition he will remain for a much longer period than with any other agent usually employed. This matter of duration of effect seems to be in a measure dependent upon the physical structure and method of administration of the agent employed. Thus, alcohol is a liquid, absorbed into the circulation from the digestive tract; it must there remain until eliminated by the excretory organs, or consumed by a process of oxidation in the system. Ether, closely allied as it is chemically to alcohol, the one being C_2H_5HO, *ethyl hydrate*, the other $(C_2H_5)_2O$, *ethyl oxide*, will, when administered by the stomach, produce almost precisely the same line of physiological effects; but owing probably to its superior volatility the duration of those effects will not be so great, its influence as an intoxicant rarely lasting for more than an hour. But when ether *vapor* is administered by the lungs, the physiological effects, while almost the same as before, are much more transient; a result clearly due to the form and manner in which the drug is administered. The vapor easily escapes from the blood and lungs. Nitrous oxide, being a highly volatile gas, escapes more readily and rapidly than ether; while the effects of the heavier vapor of chloroform are more prolonged. To this rapidity of elimination, characteristic of nitrous oxide, is doubtless due, in a measure, the comparative immunity from fatal results which has thus far attended its administration; although this is, of course, more due to its chemical constitution, as is the case also with ether vapor; the chlorine element in chloroform rendering it the most dangerous of all. Darin's statistics show a ratio of one death in 2872 administrations of chloroform; one death in 23,203 administrations of ether; and one death in 100,000 administrations of nitrous oxide. Prof. Roberts Bartholow sums up thus far an aggregate of 500 deaths from chloroform narcosis.

In regard to the safety of nitrous oxide, however, this qualification must be made, that there are very many persons who attribute permanent impairment of their health to its agency. They say, "I took nitrous oxide gas; such and such symptoms resulted, and I have never been well since." These statements must, of course, be taken with a grain of allowance, because people are notional. *Post*

hoc, propter hoc is not always a logical assumption. But I have heard of so large a number of such cases that I think the subject worthy of investigation. The late Prof. Geo. T. Barker held very decided views upon this subject with reference to his own case. He claimed, if I remember correctly, that congestion of the lungs and pneumonia followed the inhalation of the gas, and that from the effects he never fully recovered.

Dr. BARRETT: Perhaps there was nothing sufficiently definite in my remarks of last evening to demand any extended debate, and yet there are some points which, for my own satisfaction, I desire to make more clear, if possible, even if the keen intelligence of others does not demand any further elucidation. I stated that my own conclusions were that the apparent immunity from danger in the use of nitrous oxide gas was due to its lack of potentiality. I believe that to be the case. Professor Litch, if I understand him aright, attributes it to its ready elimination from the blood. I question his premises, because the disengagement depends not so much upon the volatility of the gas as upon its solubility. As nitrous oxide is much more soluble in the blood than the other vapors referred to, it would not be so readily eliminated, because of the closer bonds which hold it. A gas not readily soluble would be separated with facility, while that quickly taken up would be tardily restored again.

I stated last evening that nitrous oxide is a true anesthetic, but to produce its full effects it is necessary that it be breathed exclusively, and that all air be excluded; that the system be quickly overwhelmed with the great quantity of the gas rendered necessary by its weak potentiality. The primary influence of all anesthetics is not upon the nerve-centers, but at the peripheral extremities, and the progressing wave of domination is along the course of the nerve-filaments inwards. True anesthetics also affect primarily the sensory nerves, as might be predicated from the manner of the progression of influence. The office of sensory nerves is to convey impressions from without to the centers, and the progression of their paralysis is in the same direction. Woorari affects the motor nerves, and it commences at the nerve-centers, and the progression of its influence is *towards* the periphery. See how beautifully the proposition proves itself, as thus: The office of the motor nerves is to convey impressions from within outward, in direct opposition to that of the sensory nerves. The influence of woorari is from within towards the extremities; *therefore*, it affects but the motor nerves; or

woorari affects but the motor nerves; *therefore*, its progress is from within outwards. Of anesthetics the direct converse of this is true.

A few words now concerning the nomenclature and symbol of nitrous oxide. Nitrogen is a bivalent, and its atoms always reunite in pairs; oxygen is univalent, its atoms joining singly; consequently there can be no such compound as the symbol NO would express, because for every atom of oxygen there must be two of nitrogen, and the simplest compound which oxygen and nitrogen can form must be N_2O, and that is nitrous oxide. The two gases unite in different proportions to form a chemical series, which is something like this:

N_2O, Nitrous Oxide.
N_2O_2, Nitric Oxide.
N_2O_3, Nitrous Acid.
N_2O_4, Hyponitrous Acid.
N_2O_5, Nitric Acid.

This is according to the modern nomenclature. Formerly, I believe, nitrous oxide was written NO, to express the protoxide of nitrogen.

Dr. LITCH: I would like to state that by modern chemistry, oxygen is bivalent and hydrogen univalent.

Dr. ATKINSON: I do not accept either the old or the new nomenclature of molecular change as at all satisfactory. I hold that every atom is septivalent in its potentiality; that we have not yet surveyed the entire field so as to comprehend more than a very little of molecular change. That which is understood as a molecule is produced by at least two atoms of different kind, in combination, and the only exception known to me is oxygen, and it has been called bivalent. When combined with a diverse atom that is manifest. But when two atoms of oxygen constitute a molecule this is a different sort, or a sleeping molecule of oxygen.

Oxygen in this condition is ready to combine with any atoms having affinity for it; but to make myself demonstrably plain, I would require considerable time, and have to make drawings on the black-board. It is requisite to show the position and order of the atoms in the molecule to comprehend the awakening of the units of energy, in any measure, which the type of the molecule demands to be engaged to form its specific body, from one to seven measures. When we find these we will learn which is the skeleton or nucleus of the molecule and which is the skin or periphery of its body. Until that is understood, we cannot comprehend anything of the

change. When we talk of "physical difference" and "potential sameness," under such circumstances, we are holding our ignorance and darkness out to the gaze of lookers-on. For there can be no *physical body* without the command of the *potential energy* arranged in *typical proportions*, which must be satisfied to construct a molecule that is alive; and when it is completely satisfied, it is then what has been called dead. It is then a crystal or it is remanded to the state of atomicity; and these are the bonds we must take into account if we desire to have bodily conformation and function revealed. If we were going to write this formula according to my beloved Litch's opinion, we would have to write it in this way, N–O–N. Then the people would say at once that here (pointing to the formula) is a bond of energy belonging to this (pointing again), one of the sleeping bonds, and the other has awakened these, and it is a single one. That is called a univalent, and it is bivalent. That does not prove there are five more sleeping bonds of energy in that very atom of oxygen, and that is a single atom of oxygen, but that one is not a single atom. That is a molecule of oxygen of two atoms, and is given to us as representative of that fact. If it be written that way, you must put it that way.

Dr. Buckingham: Matter exists in the form of atoms, but it is always found in the form of molecules. The atom is the unit of the chemist, the molecule the unit of the physicist. A molecule is the smallest particle of a compound or it may be atoms of the same element. The affinity of atoms is so great that when they are liberated from a compound they immediately unite in some form. If there is no other kind present they combine with one of their own and form a molecule. This accounts for the fact that at the moment they are liberated, their affinity is very strong, but when they are combined in the molecule their affinity is partly or wholly satisfied, and hence they are less disposed to form other combinations. Some atoms will combine in one proportion, some in another. Hydrogen combines with chlorine only as one to one, with oxygen as two to one, with nitrogen as one to three, and with carbon as one to four. Water is always formed by the combination of two atoms of hydrogen with one of oxygen, and never varies. Two elements may combine in several different proportions and their compounds are entirely different. Nitrogen and oxygen combine in five different proportions. The lowest, nitrous oxide, is the gas we use as an anesthetic. The highest combination is nitric anhydride, which with water forms one of the strongest acids. N_2O, forms a molecule

of nitrous oxide, or we may write it N-ON. It is a definite compound. If we take one atom of nitrogen from it, or add one atom of oxygen to it, we form another compound with entirely different properties. Nitrous oxide, N_2O, is a colorless gas. Water at the temperature of 60° absorbs more than its own volume of the gas. Under a pressure of 50 atmospheres it becomes liquid, and may be frozen at 150° below zero. Its specific gravity is 1.527, showing that the two volumes of nitrogen and the one of oxygen are condensed into two of nitrous oxide. It will support combustion nearly as well as pure oxygen, and can be breathed for a considerable time without any serious effect.

Nitric oxide, N_2O_2, or as it is commonly written NO, is a poisonous gas. Water dissolves only one-twentieth of its volume. It is absorbed by a solution of sulphate of iron (green vitriol). It is a very poor supporter of combustion, very few substances burning in it. It absorbs oxygen and combines with it to form the peroxide, N_2O_4 or NO_2, which may be recognized by its red color. This gas is said to appear sometimes in making nitrous oxide.

Although the nitric oxide contains twice as much oxygen as the nitrous oxide, it is a poisonous gas and would soon destroy life if it were breathed.

How does nitrous oxide act when inhaled? Some think it is decomposed and gives its oxygen to the blood; but if this were so oxygen itself would be the best anesthetic, which we know it is not. Nor does it act chemically. We have three anesthetics in use: nitrous oxide, N_2O; ether, $(C_2H_5)_2O$; chloroform, $CHCl_3$, all different chemical compounds. The first is a good supporter of combustion, the second will not support combustion, but will burn, while the third burns with a very dull yellow flame. We could hardly select three chemical compounds that would be more unlike, and yet, when inhaled, have the same effect. They must act as a compound by their presence in some way not understood. If they were decomposed their elements would be comparatively inert. If we cannot determine the way in which they act, we might possibly find out what special organ or tissue they affect. Is it the whole nervous system or some special nerves, or do they act on the blood and through it on the cells, and suspend their function and stop the whole process of vitality? These are questions that can only be answered by noticing the effects of the agent during the administration.

SECTION VI.

Pathology, Therapeutics, and Materia Medica.

There was no Report from Section VI.

SECTION I.

ARTIFICIAL DENTISTRY.

PAPER BY JOHN ALLEN, OF THE SECTION.

AS the dental profession embraces different branches, and as the subject assigned us upon this occasion includes that of artificial dentistry, we propose to call your attention to the very close relation this department bears to the fine arts, for in this branch of dental science we have in many instances to reproduce, not only the organs of mastication, but also the natural form and expression of the human face. And the time has come when this should be regarded as one of the most important points to be attained in this branch of our profession.

The skillful artist is enabled to observe and study nature, and from that standpoint to see forms, sizes, shades, etc., in their minute varieties, and to catch the different expressions which are so evanescent that they would escape his attention if he did not know their source. The dentist finds that it is this reducing of things to their proper principles which elevates this branch of our profession, and gives it more the character of an art than of a mechanical trade. As, therefore, a thorough knowledge of the fundamental principles of art and science are important acquisitions alike for the artist and the dentist, we will endeavor to define some of the essential requisites in artificial dentistry in its various relations to the arts. For example, the artist finds it very necessary to become familiar with the anatomical structure of the human system, so that in his copyings from it, he may be able to transmit to the canvas the proper form, proportion, position, and expression which existed in nature's model, and thus portray faithfully the different features of the face in his picture. So with the dentist; he too requires these same qualifications in the discharge of his professional duties, and also to adopt a fixed rule to imitate nature in all cases where the natural organs or features are to be

restored, adhering to this maxim as a governing principle in the construction of artificial dentures. In executing his design, he should study the form, proportion, and expression which previously existed in the physiognomy of his patient, so that, by the aid of art, he will be enabled to restore that harmony in the features of the face which will prove true to nature; for a work of this kind cannot please unless this result is attained. In proportion as this principle is observed, this branch of our profession becomes more of an art, and is appreciated accordingly.

It is said that the value and rank of every art is in proportion to the mental labor employed in it, for then we find spirit, conception, force, and effect, and also exquisite finish. But to acquire the requisite knowledge to embody all these qualities requires the artist to be a close and careful student and copyist of nature. Whether he displays his skill upon canvas as a portrait painter, upon marble as a sculptor, or upon the human face as a dentist, he should possess a high order of artistic skill in all its details, such as the true artist displays with his brush in representing the fine texture of the skin, the indication of a vein or muscle, the waving line of beauty or of expression; for all these he goes to nature and studies her more and more in the smaller as in the greater things. So, too, the sculptor, executing his designs, labors long and earnestly to bring out a true reproduction of the proper form and position of every muscle of the face, so that each one will be in perfect harmony with the entire physiognomy of the living model which he endeavors to represent. See the watchful care of the photographer in his fine touchings over the picture formed by nature's art on his chemically prepared paper, lest in putting on the flesh-coloring he mar or deface the expression.

Now, if all this care and skill in minute detail are requisite in the arts, how much more important is it that we should observe them in our efforts to restore the natural form and expression of the face when marred by the loss of the dental organs, which are to be replaced with artificial substitutes! These should be so constructed and adapted to the physiognomy of the patient as to restore that harmonious reflection from the countenance which previously characterized the person for whom they are intended. And to do this requires artistic skill and taste far above that tame and lifeless style which renounces truth of expression and character of the features of the face.

Now, in order to avoid degeneracy of taste and poverty of conception in this branch of our profession, let it be based upon purely

scientific and artistic principles. It is upon these that we must rely in order to bring out a pleasing expression; for it is expression which dwells pleasantly or painfully in the memory. If this is disfigured or distorted by illy-formed dentures, the defacement of the countenance becomes repulsive to the beholder, and a source of humiliation to the wearer, as the result shows at once that the artist was not there to preside over the operation. But if a perfectly natural result is obtained, and harmony of the features restored, then it is evident that the requisite skill was employed in accomplishing the work.

It is said that every artist paints his own character; so with the dentist. It is by his works ye shall know him, and as he daily chronicles his own record by his works, so stands his professional character.

In conclusion, allow me to say that in the construction of artificial dentures the following important requirements should be kept in view:

First—Have the plates or foundations perfectly adapted to the mouth of the patient.

Second—Let every tooth represent its proper class and character in reference to length, form, size, shade, position, and expression.

Third—Let the gums, roof, and rugæ of the mouth be truthfully represented.

Fourth—If any or all of the muscles of the face have become sunken, they should be raised or restored to their natural contour.

Fifth—Have the lingual surfaces of the dentures of such form as to produce no impediment in the speech of the wearer; and have all these requirements so perfectly blended together as to present symmetry of form and natural expression.

SECTION I.—Continued.

Dental Prosthesis—Its Relation to Articulate Speech.

PAPER BY GEO. F. GRANT, OF THE SECTION.

PROSTHETIC dentistry does not receive the careful consideration in all its details that it deserves from the profession at large; and it may be said that what is called the decline in this branch of our art is not due so much to the introduction of cheaper

materials *per se*, as to the fact that the art, as it has been practiced, has found its proper level in the hands and materials of the men at whose door is laid the charge of its prostration.

There is nothing to prove that the work in this department which has been done in years past owed its superior reputation more to artistic skill scientifically applied, than to mere triumph of skill over refractory materials; and, viewed from this stand-point, the introduction of the new materials was an element of advancement if it had been properly regarded, for it certainly left wider scope for the application of esthetic and scientific principles, which was impossible or of great difficulty in the earliest days of the profession.

Now, while the standard of skill by which we are judged in the mind of the public has been much advanced in the department of operative dentistry, this other and not less important branch has languished and ceased growing. The most of us are waking to a realization of the fact that a change must come, and the many excellent papers which have lately been written upon the subject of the selection, arrangement, and adaptation of artificial dentures bear witness to the thoughtful attention that is being brought to bear upon the subject, and give great reason to hope that dental prosthesis will soon occupy a higher plane in the estimation of the public, as a result of higher achievement on the part of the dentist; and to assist in the furtherance of this object, your attention is invited to a consideration of the subject of this paper.

The loss of the organs which we are called upon to replace is of a serious nature, and produces effects which are of very grave importance to the whole economy. This fact is so plainly apparent to all of us, and so much has already been said and written upon the subject, that no further consideration of it in any general sense need be entered upon in this connection, but we will consider it in the special relation of its influence upon speech.

The voice is quite an important factor in the establishment of individual identity, and sometimes remains as the last feature of that identity; the one that enables us to recognize the individual at once, long after the features have become eliminated from our memory, or changed beyond our power of recognition. While this peculiarity of tone-quality, or *timbre*, as it is called, is not equally marked in all individuals, it is an undoubted fact that it is one of the first in importance of the various characteristics which mark the differences by which we determine identity. And of all the changes effected

by causes which are immediate in their result, a change in the voice is perhaps the one which reminds us most forcibly of its existence; for we may shut our eyes to other defects, but our ears are ever open to a change of voice, and particularly so to one which involves an objectionable quality of tone or faulty articulation.

The changes which most directly follow the loss of the teeth and absorption of the alveoli take the most immediate effect upon the speech, though their influence upon the voice is sometimes very remarkable and in most instances quite noticeable. Voice may be briefly described as the motion imparted to the atmosphere by the passage of a column of air over the vocal bands while in a state of tension. Articulate speech is the result of certain interruptions produced in the passage of this sound-wave through the natural channels to the outer air.

The first element in the voice governing speech is pitch. The second, which is closely allied to it and marks its idiocrasy, is quality or "timbre." When the vocal bands, under a greater or less degree of tension, are set in motion, the result is voice, and the impact and consequent reflection from the point of its incidence produces the first modification, which is pitch. The formation of articulate speech begins and is carried to its perfection from this point, for it is the result of impressions made upon this reflected sound-wave by the tongue, lips, palate, teeth, pharynx, and resonating cavities formed by the buccal walls. An approximate idea of the important part which the teeth have in the production of speech may be gained from a brief consideration of the changed relations of the other factors which are entailed by their loss. The absorption of the alveolus follows the removal of the teeth. The result of this combined misfortune is the removal of the support furnished the buccal walls and the lips, their consequent contraction diminishing the size of the oral cavity, and obliterating whatever of resonating space existed between them and the lost parts.

The tongue is deprived of much of its power by the loss of support which it had received from the teeth in articulation, and loses the aptness and precision of location which is a characteristic of it in a normal condition of the oral cavity. In fact, the loss of a single tooth from either jaw, if it be taken from a position between the median line and second bicuspid, will have an instantaneous effect upon the articulation, caused by lack of proper support to the tongue. Another very important consideration is the loss of reflecting surface involved in the removal of the teeth. From their

peculiar shape they derive much of their power in the production of tone by virtue of the great amount of surface which this form presents as a modifier of sound.

I think it would be within reasonable limits to say that the teeth present fully one-fourth of the whole amount of vibrating surface involved in the function of articulation. There are other and important changes effected in the production of speech by the loss of the teeth, but I hope to be able to treat of them more fully in considering how much may be done by way of prosthetic treatment, and of the best methods to employ in securing desirable results.

In the preparation of an artificial denture intended to replace the lost organs, we are confronted by several obstacles which seem to be insurmountable, so far as the restoration of the original conditions to the production of correct and distinct articulation is concerned. If but few teeth are missing and the loss is distributed through the arch, the difficulties attending their replacement are not so great; though a few of those little details which go so far in producing great results may very properly be noticed. In cases of this description there has been no appreciable loss of tissue which has a more direct bearing upon the articulation, than is effected by the loss of support to the tongue, or obstruction to the too free escape of sound incidental to the loss of one or two teeth. We have, however, to consider the adaptability of different materials to the purpose of retaining the teeth, and also the presentation of the minimum of obstruction to the free action of the tongue.

In the construction of a plate designed to retain a few teeth in position, a metallic base is the best, for the obvious reason that it combines the maximum of strength with the minimum of bulk. Of the metals gold is the best, from its ready adaptability and limited liability to oxidation. If the plate is supported by clasps, the greatest of care is needed to secure that relation between the plate and clasps which will insure a firm retention of the piece in close contact with the portion of the palate covered by it.

It has been customary to regard a clasp-plate as having advantages over a plate retained by atmospheric pressure, because the first could be made much smaller and thus interfere less with the free movements of the tongue in articulation. I think that this distinction has been made too sweeping and arose from a lack of consideration of the proper methods in adapting the two forms of plates.

The sounds most affected by the presence of any foreign body covering the anterior portion of the palate, as is the case where a

plate is worn, are produced in the formation of the letters J, T, D, N, S, L, R, and the combination of S and H, T and H, and C and H. The extreme delicacy of touch possessed by the tongue is well illustrated by the fact that all of these sounds are made by the contact of that organ with the teeth and that portion of the palate covered by the rugæ; or, to be more exact, a transverse section of the superior maxilla at a point between the second bicuspid and first molar of each side would include the whole territory involved in the production of these letters and combinations.

A minute analysis of the theory of the production of these sounds is not necessary to our purpose, though it is a very interesting study, and those who desire to pursue it further will find a most excellent ground-work laid in Dr. Kingsley's paper, read before the New York Odontological Society, entitled "The Mechanism of Speech," and which is the best, clearest, and most practical work upon the subject that has been published, within my knowledge. It is enough for our purpose to have fixed upon the sounds that are located in the territory within which we are working, so that we may be guided in our efforts to prevent too great a change in their quality. In general, the two styles of plates offer nearly the same amount of obstruction *practically*, because both of them occupy a large portion of the space within which the sounds above named are formed. The suction-plate extends further back, but, if properly made, need not have any more influence upon the articulation than the narrower plate supported by clasps. Neither of the plates, if made thin, as they should be, will interfere much with the tongue, provided the edges are fitted perfectly, and if in the case of the suction-plate the air-chamber is properly placed. The most common mistake made in the fitting of suction-plates is that of making the plate too small, which necessitates the placing of the chamber where it will interfere most with the articulation; and, further than this, a chamber so placed is not so effective in retaining a plate.

This is true of all plates retained by atmospheric pressure, and may as well be disposed of at once. The best results, both for articulation and for the retention of the plate, are secured by placing the chamber in the center of the roof, because whatever of natural assistance to the two points under discussion is to be gained may be found there. First, it is the point at which the vacuum is formed naturally by the tongue resting upon the parts surrounding it, and because the two most effective points of the tongue, to-wit, the point and posterior portion, are seldom brought in contact with it.

Second, there are fewer letters which are formed at this point than at any other with which we have to do.

While the shape and depth of the roof have much influence upon the quality of the voice, it is possible to gain sufficient space for our ends without much injury to the articulation by observing the following conditions:

Place the chamber near the center of the roof. In all cases have it conform to the general form of the roof, and so shaped that it shall present no abrupt projections to the tongue or waves of sound which are brought into contact with it.

A suction-plate, made in such a manner, will be found very little, if any, more objectionable from its greater size than a clasp-plate, and will offer very little obstruction to a distinct articulation. One more thought might be added to this part of the subject before taking up the subject of entire dentures. If a plate has a large surface it will be found that too high a polish increases the difficulty of speaking in two ways; first, by the formation of a vacuum between it and the tongue in certain positions, and, second, by the slipping of the tip of the tongue when it should be firmly held. The rugæ form the natural ratchets which assist the tongue in checking sound, and when they are substituted by a perfect plane the result is disastrous to articulation. My attention was called to this fact by an incident which occurred in my practice. A gentleman who is distinguished as an actor came to me for treatment of a perforation of the hard palate, which was of some considerable size. I made for him a plate of hard rubber, quite thin, and large enough to cover the entire hard palate. On trial of it his spirits, which the loss of his voice had reduced to rather a low ebb, immediately rose upon finding his voice so perfectly restored to him, and he immediately launched into a recitation of some length. I observed that some of his words were defective in finish; he said he had noticed the same thing but thought the difficulty would disappear with a little practice.

The plate was made by the "Stuck" method, so that the surface next the tongue was a perfect reproduction of the hard palate, except that I had polished it. As an experiment, I roughened the surface of the anterior portion of the plate and tried it again. The result was so satisfactory to him that he refused to let me have it again, saying, "That is perfect,"—and in fact it was surprisingly effective. Since that time I have adopted the plan of treating plates in this manner, and feel that much greater facility of articulation is

secured; also, that the flow of saliva, which in some patients is very annoying when a plate is first made, seems to be more easily controlled or kept in the back part of the mouth.

In the preparation of a denture for the full arch there are many new points which have to be considered, and in this view the introduction of plastic materials or bases has given us great benefit, and made the art of dental prosthesis embrace a wider and more useful field.

For, while a metallic base has great advantages by reason of its lesser bulk, it lacks adaptability to prosthetic uses, and can only perform the best service when combined with some plastic materials. If we have a case in which the crowns of the teeth only have been removed, or if we are called upon to begin treatment immediately upon extraction of the teeth before any changes have taken place in the alveoli or facial muscles, the most satisfactory results may be secured by the use of a metallic base.

But where the oral cavity has been reduced in size and changed in form, as in the case where the teeth have been absent for a long time, something is needed to restore the mouth to an approximation of a normal condition in its relation to speech as well as conformity to the other features. So much of this matter as relates to esthetic dental prosthesis must be left to other hands for lack of space in this paper, and a glance be taken at what must be done on our side.

If the roots of teeth can be retained in a healthy condition, it is an important consideration and lessens the difficulties by one-half. Or, if we insist upon an immediate restoration as soon as the teeth are extracted, the advantages cannot be overestimated, and ought to outweigh every consideration. The custom of "preparing mouths" for artificial dentures, as it is and has been practiced, has done us more injury than any other thing; and it is the practice of such methods that has placed this department upon the plane it occupies to-day. The work of dental prosthesis should begin immediately upon the loss of the teeth, and should be continued to the full accomplishment of its purpose. I do not mean by this that it is enough to make what is known as a temporary plate and allow it to be worn as long as it will stay in the mouth; but to make a denture that shall fulfill every requirement in form, color, expression, and the best conservation of the functions of mastication and articulate speech, and upon this structure to build whatever is needed to supply the loss of tissue consequent upon absorption. The advantages of this plan are too apparent to need enumeration, and the facilities

for its adoption which are afforded by the plastic bases ought to commend it to careful consideration.

There can be no tenable ground taken against such a position, for the only objections which may be urged are of such a nature as detract from the justice of our claim to the position we should occupy among our fellow-men.

If we could always begin treatment at the earliest period after extraction, there are some things to consider in constructing the best appliance for the purpose designed. The rules which apply to the construction of partial plates have the same application in larger plates or full sets. But the chamber can, in many cases, be dispensed with, and wherever it is practicable it should be. This is an important point, and will enable us to make a plate of uniform thickness throughout that will have but slight effect upon speech.

The crowns of the teeth should be as long and as nearly the shape of the natural crown as is possible; indeed, this may seem a small point, but a very superficial study of the acoustics of the voice will convince one that it has an important bearing.

The form of the sides of the arch should be adapted to the bearing of the tongue upon the bicuspid and molar teeth, as the integrity of many sounds is dependent upon this condition.

In stopping the passage of the air partially, as in the letters TH, R, the holding of it as in D, N, T, or the formation of a tube for its passage through the middle of the mouth, as in SL, SH, ZH, F, and V, the tongue requires the lateral support furnished by these teeth, and the arch must not be too constricted at the sides, nor can it be so wide as to allow of too great spreading of the tongue or the escape of air from the sides. The clear, free discharge of well-formed sounds requires also that no double obstruction be placed inside the teeth, as is often done to assist mastication. If we have followed the true plan of prosthetic treatment we shall never need "plumpers," but if for other reasons their use is deemed of advantage they should never prevent the perfect and easy contact of the buccal walls with the teeth, else they must not only affect the articulation, but the quality of the voice, and their use is one of the most pernicious in its effects in this regard.

If the plastic bases are used for the entire denture they should be carefully made of uniform thickness, and the whole crown of every tooth should be as clearly defined upon its palatal surface as upon the labial or buccal surface, for the purpose of aiding in every way to facilitate clear enunciation.

The edges should present the minimum of obstruction to a correct and accurate focus of the sound proceeding from the larynx. The benefit of following the method which I have proposed becomes apparent in this connection; for having once fixed the point at which the best result is secured for every consideration of facial expression, adaptability to the purpose of mastication, and distinct articulation, the necessary additions are made without prejudice to any of the important conditions, and the final adjustment of the work is easily accomplished by a duplication of the original piece.

On the other hand, if great and almost irreparable changes are allowed to go on for a period of months or years, we may justly be blamed for ignorance or negligence of our duty, though we may exercise the best judgment or bring to our aid the highest degree of artistic skill in attempting a restoration.

The chief basis upon which the advancement of the operative branch of our art is founded is *prophylaxis*, and whether we divide our speciality or not, the highest aim, the proudest achievement in our whole field of labor, will be attained through adherence to this principle in our methods.

SECTION I.—Continued.

Artistic Dentistry vs. Mechanical.

PAPER BY D. G. HARRINGTON, OF THE SECTION.

IT is always well to realize the difference between the ideal and the real, and to place a proper estimate upon each. While there is a great dissimilarity existing between these two principles there is also an intimate relation between them. Divorced from each other and the dental practitioner will either dwell in a *dreamy* land amid unfulfilled desires, or he will descend to the level of an artisan whose work, although mechanically correct, is performed with neither taste nor artistic discrimination. United and accompanied by intelligent application and we have the elements of true success. In every case the artistic should precede the mechani-

cal. Many fail of success because they have no idea what success is. The sculptor must have his model formed in his mind before he can make the cold marble stand forth as a thing of life; or the painter, the true spirit and soul of his picture in his imagination before he can portray nature's most pleasing charms upon canvas. Mind must precede matter, conception the trained hand, or our work will be of the most common sort. It is or should be the object of our schools to set a model of a perfect set of teeth before the student and then proceed to teach him how to conform his cases so far as adaptation to nature will allow to this model. To be sure, no one model is adequate to all cases; indeed, many are needed to cover the ground. But a genuine true model will greatly elevate our tastes, and aid us in bringing our work up to a true artistic standard. Artificial teeth should speak, as well as do the work of mastication; please the bystander as well as give comfort to the wearer. While we cannot dispense with artificial teeth in the mouths of the unfortunate, they should be so thoroughly concealed by art as to give the impression that they belong to the wearer.

When I have made a set of teeth which enables the patient to conceal the fact from his most intimate friends and still elicit praise on account of improved appearance, I feel as though I had achieved success. While success is within our reach in a majority of the cases which come into our hands, there are often many obstacles in the way which we should bear in mind, when we give advice in the extraction of teeth, or criticise the work of others. Extreme openness of countenance, malformation of the inferior maxillary, and sallowness of skin, for instance, are great hindrances to success. Living organs are replaced with those in which there is no life. There is no circulation in an artificial tooth. However perfect it may be in shape, color, size, and adaptation, it is only a dead tooth. Life is only the prerogative of the Almighty. We can supply only in a limited degree what is lost. Again, there is an absorption in many cases of the alveolus, going on until it entirely disappears, causing a sunken appearance both in the upper and lower part of the face which no artificial denture can restore, especially if the patient be deficient in adipose tissue. Bearing these facts in mind, we cannot but feel that it is a great calamity for any one to part with nature's gifts, which were intended for use and beauty, and in too many cases take up with the clumsy contrivances of man. While we adore nature and rejoice in her rich endowments, we often find her ways devious and past finding out. Some are adorned with a

beautiful set of teeth which no neglect or abuse can tarnish or impair, while others suffer from the earliest moments of their lives the most excruciating torments, and never enjoy the use or the ornament of a good set of teeth. An artificial set of teeth that seems to harmonize with nature and is in keeping with the features and complexion of the wearer is a blessing indeed. But those people who go on the principle that a *set* of teeth is a *set* of teeth, so long as they stay in and do the work, often render themselves a public calamity by making an unseemly exhibition of their crockery ware about our streets, and in places of public gatherings. We are reminded of a remark of Dr. Holmes's, "They often look as though they would jump out of the mouth and fasten on you." We prefer to put our subject in this way—the artistic in contrast with the mechanical—that the former element may be more clearly seen and appreciated. There is nothing in our practice which requires more patience, taste, and judgment than the selection and arrangement of a set of teeth. And yet there is scarcely anything said or written upon the subject, and the whole matter is dismissed as a trivial affair, beneath the notice of the rising lights in our profession. Sometimes the matter of articulation and expression can be arranged in a few minutes, or it may require hours; especially if there be a short upper lip, full alveolus and thin cheeks. It is our custom to engage the patient in conversation and then quietly step aside and study the effect. Had we time we should like to enter a little more minutely into the various types and consider the relations of the various sizes and shapes of teeth to these types. Suffice it to say that an artificial tooth should never be quite as large as the natural tooth, because one is a living organ and the other is not, and for that reason one appears more conspicuous than the other.

Upon the subject of color we will venture a few suggestions. It is a wide field for study, and one upon which I do not remember to have heard much said. There seems to be an impression in many minds that the lighter the tooth the more beautiful the expression. A single sister, or perchance a widow passed forty, gazes admiringly upon a pearly set of a smiling damsel of sixteen, clothed in all the freshness and glow of youth, and *wonders* why she cannot purchase these bewitching charms of nature, forgetting that time once lost will never return, whose passage through this world spares neither youth nor beauty, the loss of which no dental art can ever restore. There are two prominent complexions which we should bear in mind—the brunette and the blonde. In their pure state in early life they mark

the two extremes. The teeth of the former are white, bearing upon the straw, of the latter white bearing upon a delicate blue at the tips. Of course, they both grow darker as life advances, but those of the brunette more rapidly than the other. Between these two extremes we have a great variety, shading either upon one or the other. Midway between we often have both types combined in the same person. We often see a person with a dark skin, bearing upon the red, with sandy hair and blue eyes, and others with light, fair skin, dark hair and eyes. For such cases a neutral tint is required, in which the blue and yellow coloring is combined in the enamel, giving the tooth a tint varying from a grayish brick-dust color to a light, muddy white. This last color, varying of course from light to dark, is a color that will match more complexions than any other, and yet it is more difficult to find than any other. We have left our share of complaints at the dental depots, but not much good has been accomplished. We wish some one of commanding influence would try his hand. It seems to us that if as many experiments had been tried in this direction as there have been in the manufacture of gold foil for the last ten years, this want would have been supplied ere this. We find plenty of teeth in which the blue and yellow *prominently* appear, or teeth in which there is no coloring matter at all—whiter than the driven snow. We commend these varieties *either* to the inveterate tobacco chewer, or to those ethereal beings who would be out of place on this mundane sphere. In the style of blocks and shape of teeth, there has been an improvement of late sufficient in variety to reach most cases. There ought to be more sets made with the eye teeth by themselves so as to give the front teeth the right curve. We sometimes snip off the cuspid teeth and put them on separately. I do not belong to that class who preach up carved teeth and speak slightingly of molded blocks as store teeth. If there are but two or three tooth carvers in such a city as Boston, who have an inflexible style of their own, I do not see how you can get as well suited as you would at a dental depot where there are hundreds of styles with endless variations. It looks reasonable that a million of dollars invested in the manufacture of artificial teeth ought to command the best talent in this direction, and would if there were a greater demand for the best work. This demand will come when the best talent in our profession unite in educating the profession up to a proper appreciation of the artistic element. I believe every dentist should know how to carve a tooth, and understand just where to touch a tooth to give it expression, and to know

a natural tooth when he sees one. But to carve and bake a set so as to match every case which comes into his hands is another thing. Let us give more time and study to this branch of our profession, and not leave it too much in the hands of students and assistants. They are more likely to be mechanics than artists. If there had been as much talk and hard work put into the mechanical as into the operative, this branch would not be where it is to-day. Ought it not to be as honorable to attempt to restore the lineaments and expression of the human face as to fill a tooth with gold? One is as mechanical as the other, and either furnishes opportunities for the fullest display of art. As our Saviour delivered an only son to his sorrowing mother, so would we bring back the wonted expression to gladden the hearts of relatives and friends. While we would think no less of the treatment of the natural teeth, we would give more prominence to the mechanical restoration of what is lost beyond the power of man to save.

SECTION I.—Continued.

Artificial Dentistry.—Its Present Status, Prospects, and Possibilities.

PAPER BY EBEN M. FLAGG, OF THE SECTION.

I AM requested by the chairman of this Section to speak concerning the present status, prospects, and possibilities of mechanical dentistry. In a profession whose growth is so rapid as that of dentistry, it is difficult to define the boundary of its various departments, and we meet this obstacle at the outset in referring to what is now called mechanical dentistry. Strictly speaking, there is no operation within the range of our profession that does not partake of the mechanical; but all operations performed from the chair, during the absence of the patient, and the work afterward applied to the mouth, whether fixed or removable, have been given the name of mechanical. They may be artistic in the highest sense; they may call for a degree of esthetic culture that few attain; they may be expected to produce effects that nothing less than years of labor

and special talent can produce; but still they are called *mechanical*, and as such we are compelled to speak of them.

These operations include, first, the construction and adaptation of artificial crowns to roots of natural teeth; second, appliances for the reduction of every class of oral deformity; third, appliances for surgico-mechanical treatment of fracture, and other accidents to the jaws; and, fourth, the construction and adaptation of artificial dentures to restore functions and conceal deformities that result from the loss of natural teeth.

To cover all the ground comprised by the above definition would require more time than can be allowed a paper like the present; it must therefore suffice to briefly discuss the question as above presented.

In respect to the construction and adaptation of artificial crowns to the roots of natural teeth, we are able to record a great advance. Much is done every day to relieve patient and operator from what were tiresome and not very fruitful operations. Since the advent of the Bonwill and Richmond crowns many an operation is avoided that meant a sitting of from four to eight hours for the patient, several thousand blows from a mallet, a great amount of endurance on the part of the operator, and a piece of work that had at the best to be used carefully. Thanks to the Richmond operation, we have the presence of the patient for about two hours, and a piece of work whose strength many of us have seen its inventor test by chewing up cottonwood sticks upon it; a test one would hardly dare apply to an extensive piece of gold building. With aged patients, even if their teeth have been preserved throughout life, there is nothing that can prevent rapid wearing down after constant attrition has deprived them of the great mass of their enamel. We do not like to extract the healthy remains, while to restore lost tissue by gold-filling is an operation that nothing but a desperate condition of the patient will force him to endure. It is seldom done outside of America, and indeed it seems too much to ask even an American to submit to. The prospect of mechanical dentistry in this direction is certainly flattering, and we have a right to hope that its possibilities may extend to nearly all cases that are now treated by gold building, so that in the future operations of this nature may be performed in the laboratory, and afterward, at a short sitting, attached to the remaining roots.

Appliances for the reduction of oral deformities involve principles so well known that the status of mechanical dentistry in this

respect is not likely to undergo much change. There is, however, a better prospect of advancement in this direction, owing to increased interest that has been given the matter by books such as Dr. Kingsley's, which call closer attention to a study of the features, and it falls within the range of possibility to make the esthetic a more important consideration in this class of operations.

The present status of mechanical dentistry in respect to appliances for the treatment of fracture and other accidents to the jaws certainly should be encouraging to us as dentists, when we consider the perfection that work of this class has now attained through the mediation of the dental and exclusion of the general surgeon. The prospect now is that in future the dentist will take entire charge of all such cases, relieving the general surgeon of much special study, thereby producing a change greatly to the advantage of the patient.

It would be gratifying to record the same progress in the construction and adaptation of artificial dentures, as in the other departments mentioned; but truth requires a rigid investigation into the present status of this most important part of our work, to enable us to note its defects and suggest the remedy. We should not desire to include praiseworthy effort in a general condemnation, but it seems to-day as though the field of this work was covered by the "injun-rubber-gum-block" system. Go to the dental depots, and you will see the student with the model of a jaw in his hand step up to the presiding deity of the tooth-counter, and say to the aforesaid deity (as he has been previously instructed), "Gimme a set of 'injun-rubber-gum-block' teeth." As form happens to be a consideration in the construction of a denture, the deity of the counter draws out a tray, wherein are some eighty forms, supposed to cover the endless variations of the human tooth. These forms have been turned out by wholesale, molded in rigid metal molds. Can anybody fail to see the absurdity of attempting to produce a portrait of the human mouth on this basis? Imagine living in a world where the extent of variety in the human face was represented by eighty; and after we had seen that number of faces there was nothing to be done but see them over again. How long would it be before the progressive man would turn his thoughts to suicide? Yet this is what we find in the world of artificial dentistry to-day. If we go down to the sea in a ferry-boat, these "injun-rubber-gum-block" teeth meet our gaze. Do we ascend up into the elevated railway, they are there also. They have remained the same for years; they have

become the fashion; in the language of Shakespeare, "Age does not alter nor custom change their infinite monotony." These parodies on the human tooth divine still continue to burlesque the sacred name of Nature. They have become a monopoly, and, like all monopolies, they tend to crush individuality, and flourish in proportion as their victims lack brains. They are the support and dependence of those who advertise cheap dentistry, and wherever the dentist lacks ideality, and is unable or unwilling to devote time to the study of expression, character, and effect, there do these "injun-rubber-gum-block" teeth abound.

A few facts like those just named do not render the present status of artificial dentistry a pleasant subject for discussion; but thanks to the movement now going on for the elevation of art in America, this department, as well as others, is receiving its share of attention, and intelligent people are beginning to inquire "why old Mrs. Brown's teeth in New York look just like young Miss Jones's, of Chicago, or old Mr. Robinson's, of San Francisco?" And why should it be so palpable that they are all artificial? So that the prospect is not bad for a reformation in the matter. But when we as dental artists combine to exact a more thorough course of study on the subject, and compel students to analyze expression, character, and effect, as indicated in natural models, and attach the same importance to it in its way as we do now to the study of physiology, pathology, or anatomy; when an inharmonious expression or discordant effect is treated with the same severity as a case of malpractice in other departments of our work, then, and not till then, can we speak of the possibilities of artificial dentistry.

SECTION II.

DENTAL EDUCATION.

Union of Medicine and Dentistry.

VOLUNTEER PAPER BY WM. H. ATKINSON.

THERE has been much talk and some earnest endeavor spent in the effort to secure the acknowledgment and recognition by medical men of dentistry as a specialty of medicine, and of dentists as brethren in the healing art. From the time of the efforts of Harris and his *confrères*, in Philadelphia, to induce those in charge of medical colleges to institute a department of dentistry, which, by the way, were ignominiously spurned, there has gradually grown up, little by little, a disposition on the part of medical teachers, and more markedly of practitioners, to reconsider this question. At present there are several well-known universities in which dental departments have been established.

Curiously enough, this course has met with the disfavor of some, who assert that "*dental colleges* are quite sufficient to meet the demands of the times for an educated dental '*profession!*'" At the last meeting of the American Medical Association, a vote was unanimously passed establishing a section for dentistry, which was offered to the dentists, by the appointment of dentists as chairman and secretary to take charge of the section and be ready to make reports at the next meeting.

The International Medical Congress has also set apart Section XII. of its organization for the consideration of the mouth, and given it into the care of "graduates in medicine practicing dentistry." In view of history and in response to repeated requests to say a few words on this subject, I have at last consented to throw together some random views as a sort of starting-point for more thorough and detailed presentment of the subject.

Union is never strictly and fully attained without the loss of individuality to the things that are separate in so pronounced a sense as to make it desirable to bring them together. In so far as there is lack of union in purpose and endeavor to discover and promulgate truth in any department of associate wisdom, the want of concurrent effort on the part of the actors grows out of the stupendous plan of many in one and one in many, which greets us wherever we turn with the desire to know. Truth is one of many and many in one, or, in a word, univariety. Science is arrangement of many in one. Wisdom is the potential holding of each to the other in such antagonism of effort to dominate as to reveal the necessity of alternate *pre*dominance and *sub*dominance of each to the other to secure concurrence of harmonial activity. There are two prevailing methods of study: the first looks at things in the mass; the second attempts to unravel the minutiæ of detail in function and factor of function. When advocates of the first witness an explosion they exclaim: "What an immense power!" The second asks: "Whence the power?" and "What is it?" These are examples of the difference of the depth of the *desire to know*, out of which questions arise. One is content to contemplate externals; the other seeks to penetrate the depths of molecular change. The great lesson to learn is that each must be itself for itself in one sense, and other for other in a second sense; and, further, that no act can be repeated, *per se*, in time or space; but that progress forever obtains, even in the disruptions denominated regress, in finest changes of atoms, molecules, corpuscles, tissues, organs, systems, cycles, and maximal masses.

History is but the disconnected and interrupted footprints of travel over the field of cosmical and planetary progress—the legitimate use of which is as a rudder to guide our little ships on the ocean of advance. Love and wisdom have ever stood knocking at the door of individual consciousness, with locks wet with the dew of the night of ignorance, saying: "If any man will hear our voice, rise early and open the door, we will come in and sup with him and he with us in the plenitude of the satisfaction of the desire to know." The many-ness and one-ness of life and being has been a stumbling-block in the past history of our race only for lack of obedience to the call of love and wisdom to follow the inspirational light within us awakened into activity by the divinity of their presence with us.

Just so soon as the members of professions and other associate

bodies pursuing special activities in the drama of existence shall have discovered that no one can possibly do the work of another, there will be less exclusion and unfraternity of feeling and action among them. Blind, blundering imitations of leaders in methods of study and in execution of purpose by the "accepted" means, to the exclusion of inspirational revelations of truth, born of necessitous circumstances, adapting our perceptions to the need of the moment, is our chief dead-weight in useful career. All that ever was recorded came within our grasp through the mental machinery of those who gave it formal statement. And they perceived it because of a sense of emptiness in the text, and of fullness of inspirational surroundings.

When propositions on any subject become reduced to scientific statement, all minds capable of comprehending them unhesitatingly come into accord. Therefore, wherever there is dissent or denial, the formulation is unscientific (untrue), or those who dissent are unprepared to master the same. How much, then, of the science, biology, can be said to have had this mode of statement recorded in the required clearness? If we would inquire *how* we differ rather than why we disagree, we should be the better peace-makers among the various workers in the departments of the charming field of biological research. For so soon as we see that we must of necessity occupy individual stand-points, we should attempt to put ourselves in the other person's place of observation, that we might legitimately consider his statements. Those who seek the recognition of others in individual or associate capacity, are laboring under the apprehension of that other having something to give that is worthy to be acquired.

Singularly enough, in the experience of mankind, the things illegitimately and unworthily attained have been accorded most attention and highest practical estimate; while those of transcendent value and difficult of acquisition are looked upon with indifference, if not repulsion and disgust, as undesirable. . The easy virtue of the indolent is ever ready to follow any lead that may be fashionable, rather than to work out reliable and truthful interpretations that righteousness may become the only tolerable fashion among men.

It is pertinent to inquire as to the special recognition that medicine has to bestow upon dentistry; and the fitness of dentistry to appropriate it to the advantage of those in need of dentists' services. If we are to judge of the ability to recognize and the

worthiness to receive recognition, we should have some well-defined standard of qualification as a guide by which to bestow that recognition. To have this effectual it must be mutual, and to be mutual both parties should be so trained as to be tolerable judges of the qualifications of the other. Inasmuch as such training has not yet obtained among medical men, so as to make their instructions a tolerably unitary code of teaching, and thereby keep them one body, is it a marvel that dentistry is not yet crystallized into a well-defined and demonstrative single code of teachings? In fact, dentists know quite as much of what medical men proper ought to know, but do not, to qualify them to judge cases, as medical men know of what dentists should know, but do not.

A mutual acknowledgment of each other as alternately standing in the position of adviser and receiver of advice will tend to good results. A stilted assumption of superiority on the part of either does not tend to bring out the best knowledge in the possession of the other in consultations. The domination of strong will in the leader in any consultation does not tend to enlightenment so much as does patient presentment of what is apparent upon examination, so as to enable the slow and the weak to comprehend the case as clearly, or fail to make out a diagnosis convincing to all in the council. I am in dentistry as a specialty of medicine to-day in consequence of the prevalence of the dominating method in medical councils, in which I was involved in early practice. Financial and social advantage has been sought too often at the risk of unrighteousness in the decisions arrived at, and detrimental to the patients. It is rare to find old and accepted members in medical practice who are quite ready to meet young men in council on equal terms. In the nature of things this is inevitable as a rule. Fine appearance and a suave manner go further in securing recognition and favor than a well-stored mind in classical and professional lore. This holds even more dominantly in dentistry than in medicine.

Until the general public are better endowed and educated, we need not hope for rapid or great advancement. If required to give an estimate of those whom I deemed best prepared to select professional-council of the dentist for themselves or their wards and friends. I should be unable to select any special class—such as teachers of classics, divinity, law, or medicine—as competent as a *class* over the common people to give sound direction! And this estimate does not exclude dentists as all quite competent.

Union is the product of a felt necessity—a growth and not a

manufacture; hence, all those who attempt to court the favor and the recognition of those already in position of accepted authority, are apt to render themselves less fit for recognition, by devoting time to its attainment that should be spent in qualifying themselves by the acquisition of the knowledge they wish to be recognized as possessing. Whenever and wherever a high estimate is put upon dentistry worthily, I rejoice with a deep gratitude to the Disposer of events among men; for this has been the especial ambition of my professional career. But they "who would falsely win who would not falsely play" can never rise above the level of "mere-make-believe," however numerous the class may be.

The prevailing standard in medicine and, alas! in dentistry is unprofessional, it being "money and preferment" rather than "excellence and efficiency." The same principles that hold the reins in the government of the human body are also regnant on a broader scale in society. The so-called professions are but excerpts of societary unity. Suppose some representative of the medical fraternity should refuse to recognize dentists as part and parcel of the body of healers—would that exclude them from usefulness to those whom they serve to their great benefit and advantage? What matters it for the stomach to say to the liver, "You are not of the body!" or the blood to the lungs, "I have no need of you!" Are therefore these not still essential to each other and to the whole system to complete the round of somatic function? Let us for our own conscience' sake be so grounded in a knowledge of principles and practice as to be able to honestly recognize ourselves as fit to offer our services to the community, then patiently and quietly await the outside recognition, which is sure to come just as soon as those not of us become competent to judge of the qualification that demands and commands recognition by reason of its worth and excellence. Real capacity never seeks for recognition, nor does it reject it where it is legitimate and righteous. Let us then follow Paul's lead where he animadverts upon "holding men's persons in admiration for advantage." Advantage belongs to past stages of a struggling morality, and pertains especially to the immoral and unrighteous aspect of domination, rather than to illuminated governance.

As the latest upheavals produce the highest mountains on the surface of the earth, even so should the latest researches reveal the profoundest truths in science. This is what we claim for dentistry as the blossom of embryological and histological research. It is

the latest specialty in medicine, and includes all that was hitherto known, with whatever is especial in the understanding of the production, decadence, and restoration or substitution of the teeth and the tissues of the entire body. Just as soon as the efforts now making to bring forward *Alwato*, which is the *language* of the new science of *universology*, are completed, we shall be able to justify this claim, and take the lead in exactitude of classification in all science and art whatsoever. All who wish to realize this I would earnestly commend to the careful study of my (rather our) reports on Nomenclature and Terminology made and making before this Association.

SECTION II.—Continued.

Dental Education.

PAPER BY TRUMAN W. BROPHY, OF THE SECTION.

REALIZING full well that the subject of the education of dentists has, during the past twenty years, received the most careful consideration of the leading practitioners in this country, and has been ably presented in almost every conceivable aspect, the question naturally arises in my mind, "Can I advance any idea upon the subject that will be new, interesting, or practicable?" Notwithstanding the numerous instructive and valuable contributions to our literature on this subject, there are doubtless many new thoughts which may be garnered that will enable us to take a few more steps of progress.

Before any marked and general advance can be made in this country, one important measure should be adopted, which is the debarment in every State of incompetent men from practice. Unfortunate, indeed, it is that a uniform law could not have been passed simultaneously in the different States. The difficulty, however, in securing legislative enactments, especially to regulate the practice of dentistry, is such that those who labor in these matters congratulate themselves on procuring the passage of a bill, even though it falls far short of their ideal.

The standard of dentistry, we believe, is advancing much faster

in those States where laws are now in operation than it is in States where such laws do not exist. So long as any man who so desires can enter upon dental practice, even though he does not understand its primary principles, so long shall we have the most formidable opponents to scientific advancement within our own ranks. It is this class that brings disgrace upon our vocation, by rendering thousands toothless through their worthless operations. When laws regulating the practice of dentistry are made and executed in all the States, then we can more effectually aid the colleges and hold them responsible for the professional attainments of incoming practitioners. Advancement in States where such laws do not exist is very slow, inasmuch as the dental student of three months has legal rights to practice equal to those of the full-fledged practitioner; and, consequently, having no inducement to further study, he does not attend college; hence the profession and the laity alike suffer because of his inefficiency. With laws in operation which demand that candidates for admission to practice shall possess a diploma from some reputable dental or medical college—if from a medical college, he should pass a satisfactory examination before a board of censors as to his skill in dentistry, unless dentistry is taught in this college—we may next inquire: "*What should be the prerequisite of the candidate for matriculation* in our professional institutions of learning?" On this subject most of us stand in about the same attitude as the moral philosopher who writes beautiful theories, advises grand actions, but falls far short of living as he directs others to live. Most desirable is it that all who aim to enter upon a professional life, should possess a classical education. Few, comparatively, have enjoyed such advantages. I believe, however—and history verifies this assertion—that any one of vigorous habits, endowed with sound common-sense, with an education such as can be obtained in the free public schools of America, is qualified to enter upon the study of a profession; provided that there is behind this a determination to learn, he *will* succeed and attain an honored place in his profession. The illustrious name of Abraham Lincoln, shining as a bright star in the history of the nation, furnishes us with a striking example of what may be accomplished without a classical education.

No doubt too many students are admitted into our colleges whose educational qualifications are not sufficient to enable them to comprehend the lectures delivered. Substantial advancement we cannot have unless our colleges demand that applicants for matriculation

shall pass a written examination at least in the English branches taught in our public schools; better, indeed, if examinations on the higher branches were required. "Of all the defects in our system of educating men for the practice of medicine and surgery,"—including dentistry, of course,—"none is greater, or productive of more injury to the community and to the profession itself, than this want of preparatory knowledge and discipline on the part of those who enter it. It narrows the field of mental vision; limits the material for comparison and criticism; precludes the possibility of apprehending the philosophy or reason for many things, and consequently compels the acceptance of the opinions of teachers and writers without question; and embarrasses every step of intercourse either with professional brethren or with the community. These embarrassments and limitations to the progress and usefulness of individuals necessarily involve corresponding limitations to the usefulness and honor of the profession as a whole. Improvement here, at the threshold of the profession, is naturally the first and most necessary step towards the accomplishment of needed improvements in all other respects. All must agree that the time when the standard of preliminary education should be enforced is when the student proposes to enter upon his professional studies. First, because the mental discipline and knowledge resulting from such prior education are necessary to qualify him to prosecute his studies with facility and success. And, second, because to permit him to spend three years of time and a considerable sum of money in pursuing professional studies, and then reject him for lack of acquirements which he should have had before he began, would be so manifestly unjust as to need no comment." It is gratifying to know that some of our dental colleges are insisting on preliminary examinations, and that they do not hesitate to debar from matriculating those who cannot pass. It is hoped that this example will be adopted and faithfully carried out in all the schools.

Is dentistry a profession in itself, as some of our members contend, or did this Association put itself in a ridiculous position by asserting many years ago and embodying in its Code of Ethics the clause, "Dentistry is a specialty in medical science?" We respect too highly the framers of our Code to question their veracity or judgment, or doubt their motives. If "dentistry is a specialty in medical science," as we most candidly believe, then it is absolutely impossible that it be a profession in itself; and whoever makes use of the term, the "dental profession," is invariably in error. With equal

propriety we might speak of ophthalmologists as being members of the ophthalmological profession, etc., etc. If dentistry *is* a specialty of medicine, every dentist is, or rather ought to be, a medical man. The question, however, is frequently asked: "Is not the man who constructs artificial dentures a dentist, and do you assume that he should devote three years to the study of medicine?" This scarcely needs to be answered; the most careless observer practicing dentistry must realize that operative and mechanical dentistry are as incompatible as operative surgery and the manufacture of surgical appliances. Mechanical dentistry is quietly but most surely drifting away from operative dentistry, so that we might safely say that comparatively few members of this Association practice both the operative and the mechanical departments. The mechanical dentist should possess artistic mechanical skill; he should be well versed in the chemistry of the metals; have a thorough knowledge of the anatomy of the muscles of expression; be thoroughly instructed in manipulating the materials of which artificial dentures are constructed; and be able to select and arrange artificial teeth in imitation of nature's forms. It is not, or should not be, within the province of his duties to treat oral diseases, not even the diseases of the teeth themselves. The high art which he must be competent to execute, if he expects to be successful, does not require a knowledge of the principles and practice of medicine to insure the most satisfactory results, no more so than does the manufacturing of artificial eyes, or of any substitute for other lost portions of the anatomy. On the other hand, it is generally conceded by well-educated practitioners that a knowledge of the principles and practice of medicine and surgery is absolutely essential to the successful pursuit of operative dentistry. No one can practice dentistry successfully without practicing medicine constantly. The very nature of the work required is such that the practitioner cannot well change from laboratory to operating-room at frequent intervals, as is necessary when carrying on both departments; besides, the highest success in the art of mechanical dentistry cannot be attained without long and careful study. In a word, mechanical dentistry in all its branches is so high an art, and requires so much time to master its intricacies, that it is absolutely impossible for the student to gain a knowledge of this and the operative department—in the time required by our dental colleges—necessary to practice both successfully. Therefore, I believe that all students who aim to practice in cities or towns of considerable size should resolve to practice

exclusively one or the other branch. If, however, they should choose to practice in the country, they should, of course, be able to construct artificial dentures in conjunction with operating; with this in view, and a growing demand on the part of dentists for a knowledge of medicine, we believe that the cause of dental education would be greatly advanced if the learning of mechanical dentistry were not made compulsory in our colleges, and the time now devoted to it were spent in the pursuit of medical studies.

The demand for medical knowledge among operative dentists is increasing with such astonishing rapidity, and with equal rapidity is it that artistic mechanical dentistry is passing into the hands of experts in this department, that there should be a change made in the curriculum of our colleges to meet the requirements of the students as well as the community which in time will employ them. *All men who aim to practice operative dentistry should receive a full medical education*, and enter upon the specialty of dental surgery with a knowledge of the underlying principles of medicine and surgery equal to that possessed by other specialists. If they desire to be mechanical dentists they can devote themselves to this department, and when found qualified receive a certificate to that effect.

Dental surgery, properly practiced, is a specialty in medical science, and therefore should be taught as other specialties are in medical colleges. Ah! but, some one says, how absurd it would be to attempt to teach dentistry in a medical college, whose professors know nothing of it. What! teach dentistry in a medical college, the very atmosphere of which impresses the dental student as though a stranger in a foreign land! With equal propriety the same argument a few years ago might have been made or urged against the teaching of ophthalmology and otology in our medical colleges. Indeed, it was within the last century that surgery was first recognized in England as being worthy of a position in the medical profession, as worthy of being taught in the medical schools. We hear from those who advocate the present system of teaching dentistry that too much time would be required to educate a student in medicine, including his dental training. Let me ask, What is the curriculum embraced in our dental schools? It is the teaching of filling and treating diseased teeth, constructing artificial dentures, and imparting a partial medical education, followed by conferring a degree that few understand to mean that the possessor is a professional man. The importance of educating dentists in medicine was fully recognized by the pioneer dental teachers of our country. How

enthusiastically did the late Dr. Chapin A. Harris, he whose name we all love and venerate, with his associates, labor to establish a department of dentistry in a medical college in Baltimore! And no doubt those of our elder brothers with us to-day who knew him well could relate to us the expressions of bitter disappointment that fell from his lips when he saw that his fond and just desires in the interest of suffering humanity, owing to the opposition of the medical faculty, could not be realized. The great error committed by this medical faculty had the effect of isolating the teaching of dentistry. Had Dr. Harris been successful in establishing chairs of dentistry in a medical school, the dental college probably would never have been established, and the influence of the medical profession, embracing dentistry, would have been greater; dentistry would have been more respected, and its sphere of usefulness doubtless would have been far more extended; as medicine advanced, so would dentistry. The memory of this unfortunate event in the early systematic teaching of dentistry engendered feelings of animosity between the medical faculty and the dentists immediately interested that still finds place among men who are unable to forget mistakes, and who seem to regard this error of medical men forty years ago as a sufficient cause for refusing medical education to dentists, and consequently retarding the advancement of dentistry for all time to come.

In 1839, when our first dental college was organized—the Baltimore College of Dental Surgery—there were but four professors, all medical men. Chemistry, microscopical anatomy, histology, materia medica, and surgery were not a portion of their curriculum. The demand, however, for more knowledge in the above and other branches, has been such that from time to time additions to the faculty and to the facilities for teaching have been made, so that at the present time, in the best of our dental schools, we not only have the above branches taught, but the chemical laboratory, the dissecting room, and the physiological laboratory have been established, and the attainments of recent graduates attest the superior advantages they have enjoyed, compared with those of their less-favored predecessors.

Gradually the standard of dental education has been raised, till now many of our profession believe—and their belief is shared in by some of the most distinguished professors in our dental schools—that dentistry should be taught in our medical schools, and that our dental colleges now in operation should unite with the medical colleges,

utilizing the teachers in both, so that the greatest good may result in making our students educated professional men. There is a class of diseases met with in the oral cavity which the general practitioner is not as a rule qualified to treat, since he has not been instructed in the pathology of the teeth; neither is the dental graduate qualified to treat them, since his knowledge of general pathology is not sufficiently extensive to enable him to appreciate and successfully antagonize unfavorable local or constitutional symptoms that might arise. Therefore, the unfortunate patient afflicted with such oral lesions is sent by the physician or the general surgeon to the dentist, since the surgeon does not understand the case, but believes the dentist can give relief; and the dentist, not being acquainted with the character of the affection, remands the patient to the physician or surgeon from whom he came, saying, "I am unable to associate the affection in this case with the teeth." The patient consequently obtains no relief, for the reasons that the physician has not been educated in dental diseases, and that the dentist has not been educated in general diseases. Moreover, if the physician acts on his own responsibility, and there exists in his mind the least suspicion that the teeth may be the cause of neuralgia or other affections, too frequently he advises their extraction; and the dentist, for the reasons above stated, extracts them without hesitation, although the operation may not be warranted or at all advisable. For these reasons the students who aim to enter upon general practice, as well as all specialists, should be educated together in the medical schools.

If mechanical dentistry is not made compulsory, the medical colleges, by adding efficient instructors in the principles and practice of dental surgery, are far better adapted to teaching the dental student than the dental schools as now organized. Let the dental student take a full three-years' course in a medical college; let him attend all the lectures; let him, while those who aim to follow a general practice or some other specialty are receiving instructions in their departments, be present in the dental infirmary receiving practical lessons under the guidance of efficient demonstrators; let this be done during a period of three years, after which he may come up for examination, and, if qualified, receive the degree of M.D., a title which is sufficiently broad to cover each and every department of the healing art, and under which all practitioners, either general or special, are recognized as members of a time-honored profession which ranks first in point of usefulness among the learned professions of the earth. As other students receive certifi-

cates from special instructors, so too should he who has qualified to practice the specialty of dental surgery. We need not fear that dentistry, as some contend, would be degraded by thus teaching it; on the contrary, it would immediately take a more exalted rank in the estimation of the community. It would be no longer regarded as a mechanical trade by many intelligent men, but would take its position on a level with other departments of medical science.

DISCUSSIONS.

Dr. LITCH: The leading thought in the paper just read by Dr. Brophy seems to be that the time has now come when dental colleges as such should be abolished, and dental education be sought for in medical schools, or under the patronage and supervision of medical schools. While I agree with the doctor in the opinion that the ideal education for the dentist is a thorough medical education as a foundation for special instruction in dentistry; while I agree that that is desirable in every way, I can hardly agree that just at the present hour and time it is fully attainable; and I furthermore disagree with him in the assumption that dental colleges, as at present organized—the best of them—do not very well qualify the dental practitioner for his special work. Our best dental colleges have a chair of anatomy, of physiology, of general chemistry, and of materia medica, which are the four fundamental branches of medical science. The ordinary medical school has, in addition, a chair of practice of medicine, of obstetrics, and of general surgery. We all recognize the fact that, while it is important that the dentist should understand the principles which underlie general diseases and their treatment, it is not essential that he should have a very thorough knowledge in reference to the details of such treatment, or of the details of the practice of general surgery, because it is outside of his domain. He should know the principles, and if he knows the details fully it is helpful—desirable, perhaps—but not absolutely necessary any more than it is for the practitioner of medicine to have a knowledge of the technicalities which make up the dental specialty. The physician should know the principles of dental physiology and pathology, of which he is at present abundantly ignorant, but we do not expect the practitioner of general medicine to grasp all the details of the dental specialty. Furthermore, I contend that the medical curriculum, as at present arranged, is not

adapted to the needs of the dentist, for the reason that in that curriculum dental physiology and pathology are almost absolutely ignored. A gentleman, who is not now present, but who is a distinguished member of the dental profession, said, in a paper read one year ago, that in a three years' medical course in a leading medical school he had failed to hear one respectful reference to dentistry or dental pathology; and I think that that will be found to have been the experience of every dentist who has graduated in medicine. That at least has been my experience. One need but turn over the pages of our medical text-books to see how very meagre is their information in regard to dental pathology and therapeutics, and if it is true of text-books, it is true of instruction in schools. Take up a medical text-book on the materia medica, and you will find in the whole list but two or three allusions to the use of drugs in dentistry. You will perhaps find the century-old advice that oil of cloves is good for toothache; but certainly not a hint as to the pathological condition in which it may prove alleviatory. Dental surgery is as entirely ignored as though there was no such thing as a tooth. The medical course, then, as at present arranged, cannot be said to give the proper training for the dental student, because the course is built up for the education of medical practitioners and not of dental practitioners. Until a little more progress is made by the medical profession, in recognition of the claims of dentistry to be ranked as a legitimate branch of scientific medicine, it is better not to abandon the old schools, which have done so much towards advancing dentistry to the standard it at present occupies. Dentistry is a fine baby; she has attained her present growth and proportions under the jealous care of those who loved her; let us not intrust her future to the tender mercies of a foster-mother who has proved herself to be either contemptuous, indifferent, or mercenary; contemptuous except in so far as she is indifferent, and indifferent except in so far as she is mercenary.

Do not understand me as ignoring what measure of recognition the claims of dentistry are now receiving from the medical profession; but we must recognize the fact that there is on the part of medical men a wide-spread disbelief and incredulity in regard to the validity of those claims, and this skepticism is largely the result of ignorance on the subject; because only the men actually engaged in work in the dental field can realize the extent of that field, and only a man so engaged can realize how absolutely essential to the highest success in that field is a broad scientific culture. This,

of course, medical practitioners are not capable of fully appreciating, although I think the time will come soon, when they will have a fuller realization of this truth; but until that time comes let us not trust dental education in the hands of men who are not prepared to insist upon its thoroughness because they do not recognize the necessity for thoroughness, and who have not even that incentive to strictness of requirement which an honorable *esprit de corps* must give.

A great deal has been said about preliminary examinations. This I hold to be desirable, but it is not required in a majority of our medical schools, and until it is so required dental schools can hardly be expected to set up a higher standard. I do not hold a classical education to be essential, although I consider that it is desirable and eminently helpful to the student in every domain of science, especially in medicine, because the nomenclature of medicine is so based on classical languages that the ordinary student has a great many difficulties to overcome without a knowledge of the Greek and Latin tongues. With an ordinary good English education, however, a very fair amount of progress can be made. A large proportion of our physicians and surgeons have started without any classical training, and many have acquired it in the course of their studies.

In regard to the separation of the mechanical and operative branches of dentistry, I think that while it may be eminently desirable it will be found impossible of attainment, as a rule. It answers very well in large cities, but the gentleman who should settle in an ordinary country town or village, and confine himself exclusively to the manufacture of artificial teeth, would pick up a very meagre living. This is not practical in the dental profession any more than in the medical profession. How would a man thrive who went to a village to make a living by treating diseases of the eye alone? It is eminently proper that there should be specialists in ophthalmology in large cities, but the general practitioner in the country must be such in every sense of the word. The average patient is not able to travel hundreds and thousands of miles for the treatment of ordinary lesions of the eye, while an inhabitant of the city naturally seeks the advice of an ophthalmologist.

This is true also in regard to dentistry; the average practitioner must be a general practitioner in order to meet the requirements of his patients and secure for himself a livelihood. A higher degree of skill in either branch can, of course, be attained by an exclusive devotion to either; but the average man can do good work in both;

and I repudiate the suggestion that there is anything derogatory in either, or in one more than in the other.

A few words in regard to the matter of laws for the regulation of the dental practice, which were alluded to in Dr. Fillebrown's paper. It is one of the most potent influences for securing the advance of dentistry which we can have recourse to. The securing of intelligent legislation upon the subject, as was stated by the gentleman, is a matter of immense difficulty. Legislatures have to be organized in the interest of such bills with almost as much care as in the interest of a corporation, and as there is not so much money back of dental acts they do not get through so easily as great corporations with their bills. There is, too, great difficulty in enforcing legislation when obtained, owing to the laxness of public opinion. In Pennsylvania, a committee appointed to bring cases of infringement before the courts brought two or three suits; the plainest and most palpable cases of infringement went before the jury, and verdicts were brought in for the defendants in spite of the law and the evidence and the charge of the judge, and only because of the lax public opinion upon the subject of dental legislation.

Dr. SHEPARD: Criticism of the present methods of education, and suggestions for their improvement from those not engaged in teaching are of value and should be gladly received; yet it is true that such observers cannot understand as well as those who have had years of experience in teaching what are the difficulties to be encountered and overcome and the hindrances to advance.

The chief difficulty in carrying out the idea of the second essay is that up to the present time our profession does not attract a class of students who have the pecuniary ability to afford a long course of professional study. It is also a fact to be regretted that few young men who are classical graduates enter the dental profession. When the time comes that our calling is sought by such men, as will doubtless be the case by and by, this difficulty will be removed. There is no doubt that every advance in the breadth and thoroughness of our educational methods is hastening that day. But that this time is remote is shown by the fact that but a minority of those yearly entering our profession avail themselves of the training of our dental schools, where courses are short and easy in comparison with those of the medical schools, and of this minority the majority select the easiest and shortest courses. I ask those qualified to judge if this is not a fact of observation. If it is, we certainly have a condition of things which makes the adoption of the medical

course still more difficult. Another objection to the second paper is that it attempts to set aside the arithmetical truth that more cannot be crowded into any three years than said years will contain. If it is true that a medical course requires three years of actual study, how can the student properly acquit himself in these studies and so master them as to successfully pass his examination for his degree of M.D., and during the same three years have time for his special dental studies and the acquisition of manual dexterity so as to be qualified with the skill necessary to perform dental operations? According to arithmetic, such a student must be more talented and more diligent than one preparing for medical practice simply, or he must neglect some parts of the medical course and hence be less thoroughly educated medically than the other; or we must conclude that the requiring of three years for a medical course is not necessary and gives a student much spare time. The only position for those favoring the full medical curriculum for dentists to take, is to advocate the addition to the three years of another year, which should be devoted to special study and practice in the infirmary.

In the institution with which I am connected there is no distinction between the medical and dental students during their first year of study. The whole year's work in anatomy, including dissection, physiology, and chemistry, is identical with the same examinations at the end of the year and the same requirements for successful results. We have demonstrated that our students cannot fulfill these demands and at the same time do any extra work in dental study or practice. Hence they are advised not to devote any of the first year either to the laboratory or infirmary. At the end of the first year the dental student branches off from the medical student and devotes all the second year to dental study and the acquisition of manual dexterity; some even find they must remain a third year to pass all the examinations. In the medical school its second and third years, in like degree, engross all the student's energies and leave no time for any specialty.

The essayist makes a grave mistake when he states that the specialist in dermatology, otology, etc., is prepared for practice when he graduates as an M.D. It is a fact, on the contrary, that the great majority of such specialists devote much time, after graduation, in special hospitals, at home and in Europe to the acquisition of their special training and skill. Many whom I know have spent years abroad, after graduation, at the clinics of the masters of their specialties, before they considered themselves qualified to practice. No

fault could be found with the advocates for the full medical curriculum for dentists if they would urge such a system. They would then be consistent, for they would be advocating a higher education instead of making less thorough and broad medical training.

Dr. ODELL: In the paper, or in the remarks of the speaker that followed the paper, it was stated that "no remark was ever heard in any medical college referring to dentistry in a respectful manner."

Dr. LITCH: My statement was that a distinguished practitioner had made the statement in a paper read a year ago, that in attendance upon a two or three years' course at a medical school, he had not in the whole time heard a single respectful reference to dentistry.

Dr. ODELL: Then I was wrong in imputing the remark to the speaker instead of to his quoted authority. In our New York University Medical Department, however, I must beg to assert that there was a continual reference to dentistry, wherever it was admissible, wherever it was possible, in some connection, either with the teeth, or often as low down as the pelvis. I remember very distinctly that the chair of obstetrics recognized dentistry; for in my examination the very first question was, "What do you know of forceps?" That was only preliminary to putting me through the various positions, but there was an allusion to dentistry there very plainly. When I came before the professor of microscopy, he did not dream of asking me anything out of the teeth; it was *all* teeth, and I was disgusted with such continual reference thereto. I expected to be examined on what I had been "cramming;" he examined me on what I had "crammed" years ago, and pretty nearly crammed me into trouble. I merely beg to give credit here where it is due, because, in the sweeping charges made against one college or claims made for another, we are apt to take such very broad ground that we leave out some facts, and we fail to give some parties credit, while we claim the credit for ourselves, or our individual institutions.

Dr. STOCKTON: I believe the higher the education of any man for any calling in life, the better he will perform the duties devolving upon him. If I had to begin dentistry again, I would become a thorough medical man. I would thereby have more confidence in myself, and the confidence of the community would the more easily be secured. While dentists should know much more of general medicine than many of us do, medical men, too, should know something of the matters pertaining to dentistry. And this is illustrated by an incident that occurred only the other day. Some

months ago I filled the two lower sixth-year molars for a little boy; they were very badly decayed, and I filled them only for the purpose of keeping them until a proper time for their extraction. The pulp in one of them unfortunately died, and ulceration was threatened. The little fellow suffered considerable pain, and his parents sent for the family physician, who did just what other non-dentally educated physicians have done in similar cases, advised a warm external poultice—the very worst possible thing to do. The face swelled, and when suppuration had taken place, he lanced it externally, thereby leaving a scar for life, and then said, "As soon as the swelling subsides, you had better go to your dentist and have the tooth extracted, for there is danger of *periostitis*." Now, I think the doctor wanted a little dental education. I said to the father, "I am your dentist, and hereafter when anything is the matter with the teeth, come to me or send for me. I do not propose to interfere with your physician in any of *his* duties; neither do I want him to interfere and do harm when I can so easily prevent it." I believe in a medical education for dentists, and also in considerable of a dental education for physicians.

Dr. Brophy: I desire to answer briefly the remarks made by the gentlemen who have discussed this subject, and I ask your indulgence for a few minutes. I would like to ask the definition of the word *dentistry*. *What is dentistry?* I ask Prof. Litch.

Dr. Litch: It is the art and science of treating diseases or pathological conditions of the teeth.

Dr. Wetherbee: I hope he will amend that, and allow it to cover more ground. I think it is the science and art of restoring abnormal conditions of the oral cavity to a normal condition.

Dr. Litch: It seems not.

Dr. Brophy: Artificial dentistry, then, according to Dr. Litch's definition, is not dentistry, since he says: "Dentistry is the art and science of treating diseases or pathological conditions of the teeth." I asked the question of Dr. Litch for the reason that I desired to challenge an assertion he made, which was, that medical men generally know very little of dentistry. I wish to quote his words as nearly as possible. If this statement be true, if medical men generally know very little of dentistry, then anatomy, physiology, chemistry, pathology, therapeutics, materia medica, and hygiene have nothing to do with dentistry, for it is generally conceded that the average physician knows far more of the branches of science mentioned than the average dentist.

If medical men know very little of dentistry, why are there so many of them holding professorships in our dental colleges?

If medical knowledge is not necessary to the dentist, the teaching of the branches just named should be abandoned in dental schools. Dr. Litch assumes that the practice of dentistry is based upon a knowledge of pathology and therapeutics, and yet he says that physicians know very little of dentistry.

Dr. Allen says the time has not come to teach dentistry in medical colleges.

To answer this statement in full would necessitate a repetition of a portion of my paper. I have no desire to consume your time to that extent. I refer you to my paper in regard to that matter. No one will claim that a recent graduate from a medical college is an educated practitioner; that is to say, an eminent practitioner. Eminent practitioners, either general or special, are not made in medical colleges. The *foundation is laid there*, upon which the young man may build a reputation that will place him among the foremost in his profession.

The medical schools instill into the minds of their students the *principles* of medicine, without a knowledge of which the practitioner is ever in the dark, and consequently cannot succeed. The understanding of these foundation-principles is essential to the dental specialists as to other specialists and general practitioners. Well grounded in these principles, the student can intelligently pursue special studies in whatever department of medicine he may select.

We do not want young men to come out from the dental schools without first acquiring a knowledge of the principles of medicine upon which to build the specialty of dental surgery. It is, indeed, impossible to thoroughly understand special pathology or the pathology of the teeth and associate parts without first attaining a knowledge of physiology and the principles of *general pathology.*

The teaching of dental pathology, without first teaching the principles of general pathology, might be compared to attempting to build the roof of a house before the foundation is put in place. It has been said that a knowledge of medicine is not necessary to the successful practice of dentistry; that dental students have not the time to pursue medical studies. Why, I ask, are so many young men, graduates in dentistry, taking a medical education? Why are so many going from dental schools to medical schools and taking a full education in medicine and surgery? For the reason that they do not get what they need in the dental colleges to enable them to practice dentistry in a manner satisfactory to themselves. I do not wish the

impression to go out that I am opposed to the dental schools, or that I am speaking disparagingly of them. I owe a great debt of gratitude to my dental *alma mater;* yet I sincerely believe that if medicine were taught in those schools, or if the dental professors were connected with medical schools of high standing, every student receiving such advantages and such training would be better qualified to practice the specialty of dental surgery. It is absurd to say that the dental student has not the time to include, during his college course, the whole curriculum of medical studies, or to assume that he requires more time in college in preparation to enter upon practice than is required by the ophthalmologist in preparation for the practice of his specialty. Dentistry is no more profound a science and art than ophthalmology. Let me ask you what would be the standing of the ophthalmologist if he were to commence practice without having taken a full medical course and contend that he had not the time to do so; besides, the eye was his specialty, and he had no desire for a knowledge of the other organs of the body? Dr. Shepard has said that few young men attending his college are willing to enter upon a prolonged course of study, such as is required of the medical students; that they have neither the means nor the preliminary education, in many instances; and that they are not from families of culture, position, and wealth. This is not only true of his school, but the same condition of affairs exists in all the dental colleges. Why is it so? It is for the reason that they do not regard the study of dentistry worthy of their attention.

When the dental department of Harvard University (as well as other dental schools) requires as a prerequisite to matriculation an examination equally as searching as the one to which the medical students of the same university are subjected, educate their students as thoroughly, and confer a degree which is recognized and generally understood in our country to mean that the possessor is a professional man, there will be no dearth of young men of family, position, and wealth pursuing the study of dentistry. So long as the dental department of the time-honored university with which Dr. Shepard is connected is willing to accept students who have been rejected by the medical department, or debarred from matriculating therein, so long he must expect that young men of family, position, and wealth will not be found among his students.

About the three-years' course of study: I do not expect a young man, a recent graduate, to be an eminent practitioner. We expect, however, that after he has pursued his studies three years, as indi-

cated in my paper, he will have the principles underlying the practice of medicine and surgery, coupled with a knowledge of the principles of dental surgery, thoroughly incorporated in his mind, and the same practical knowledge and experience which he now obtains in the dental infirmary. In order to attain the highest success, young men who aim to follow specialties must have well-directed special study in the department they have chosen. It is as proper that the dental graduate should be especially trained under the guidance of competent teachers after passing from the school as it is for other specialists. This post-graduate training, I believe, can best be conducted in private offices, where so much is to be learned that is essential to success in practice.

Dr. SHEPARD: You state you agreed in having a supplemental course; you are contending that it should be done in three years.

Dr. BROPHY: I contend he would be better prepared to practice in that time, and in the manner I have advocated, than he would be under the present system of dental college management. On the subject of artificial dentures, I agree with Dr. Allen. Every gentleman who spoke said artificial dentistry was so high an art that young men cannot acquire a knowledge of it which will enable them to practice it successfully within the time required to graduate from college. We have only a few artificial dentists in Chicago who are eminently qualified in that department.

About the dental law: While it may be difficult in all cases to enforce it, it has, in all States where it exists, a very good moral effect.

The advantages, Gentlemen, which would be derived by the community, and the certainty of our true advancement by having the dental students and medical students all educated together, so as to enable them to better understand the relations which exist between the organs of the human body when invaded by disease, are so clear to my mind that I see no ground for argument.

Dr. HUNTER: It appears to me that we underestimate the importance of artificial dentistry when we seek to divorce it from operative dentistry. It has been plainly shown that when a person is in need of artificial dentures, the best judgment, the highest artistic attainments and integrity are essential to retrieve the loss of the natural organs in restoring the features, expression, enunciation, and mastication; and, instead of degrading and assigning it to charlatanism, and making it a mere mechanical trade, and throwing it out of our colleges, there should be even more pains taken to develop the skill and fine art properly belonging to that important branch of our profession.

To overcome the evils complained of, our methods of thought and practice need to be reconstructed.

No dentist should take an office-boy or student (for the office-boy too often graduates himself, and dubs himself doctor or surgeon-dentist in pretentious hand-bills, and warrants all work, and then begins his evil course) unless he is gifted with natural mechanical and artistic faculties of a high order, together with good intellect and undoubted integrity. For without those gifts by nature, it is as impossible to become a competent dentist as to make gold from the baser metals, or to make a good and honest man of a Guiteau, in whose constitution fiend was indelibly stamped before his birth. So, let us begin at the right time and place to make good dentists. Let us commence with good material in our offices, instead of examining for color-blindness or other disqualifications on application to enter college. Too much time is then thrown away by the young man, and he is subjected to mortification and injustice if found incompetent, after having been allowed or encouraged to make an abortive effort to become a dentist. It would be better to be able to tell a young man what calling he is or is not adapted to engage in for a life-work, than to do him, the dental profession, and society wrong.

Dr. SHEPARD: The essayist, and those who have spoken in favor of the M.D. course, fail to give us a very complete presentation of their plans.

It is a fact also that the training of our medical schools is defective in many respects, notably so in regard to the teeth. The eye, the ear, and the skin receive much attention; dental tissues almost none. The young men preparing for medical practice should be as thoroughly instructed in the latter as in the former. The medical school would then be complete, with no distinction between one specialty and another.

The possessor of this broad education would then, after graduation, perfect himself in his specialty at the proper hospital. It is much to the discredit of all medical schools that they turn out men as educated who are so ignorant of such important organs as the teeth. All of us know that the ignorance of medical men about the teeth and their diseases is most lamentable, and brings much suffering and loss to the community. Our first efforts should be to have in the medical curriculum proper dental teaching for the young physician.

We ought also to condemn the custom of some medical schools of advertising their offer of the M.D. to graduates of dental schools

after one year only of additional study. Is any one so foolhardy as to assert that two years in a dental school and one year in a medical school are equivalent in medical training to three years in a medical school?

We all know that this plan is a cheapening of the M.D. degree. Because a man is to practice dentistry, should he obtain his degree of M.D. with less medical knowledge than he who is to practice medicine? The selling of a degree which means a definite thing to one man upon certain conditions and to another upon less is a fraud, and the parchment tells a falsehood. One is a full education and the other a partial education. It can only be made legitimate and honorable by the proclamation from medical sources that medical education is changed from former customs, and, like our classical institutions, has elective studies from which the student can select which he will follow and which ignore.

Dr. BUTLER: Does Harvard offer such terms?

Dr. SHEPARD: It does not.

Dr. BUCKINGHAM: Do they not take the dental graduate on better terms than the outsider?

Dr. SHEPARD: The candidates for the M.D. and for the D.M.D. pursue their studies the first year together, no difference being known between them in their studies or in the examination at the end of that year. The dental student then takes his second year in the dental school, and, if successful in his examinations for that year, also gets his degree of D.M.D. If now he wishes the M.D., he goes back where he left off at the end of the first year of the medical school, and takes the whole second and third years in that school. His second year of dental study does not count for the medical degree. This, as you will see, makes four years for the two degrees. Some go through the full medical course of three years, and then take the last year of the dental school, which is the same thing, only varied in order.

Dr. BUCKINGHAM: Can they take the two years in the dental school and the same in the medical school at the same time?

Dr. SHEPARD: I should say not; certainly none ever have. The hours of lectures, etc., are not so arranged that one could. The studies of the second medical year and second dental year are distinct.

Dr. BUCKINGHAM: Can he by law?

Dr. SHEPARD: My impression is that he cannot by law be a candidate for both degrees at the same time. But a student in any department of the University can attend the instruction in any other department or all the departments if he can find the time.

Dr. BUTLER: The principal argument that has been used in the remarks on the essay on dental education, I think, is one of the poorest to be brought before such a body. The day is past when there is any necessity of endeavoring to bring men into a profession, whether it be medical, dental, or any other, by the short-cut, or on the claim that they cannot afford to spend the necessary time for proper preparation. Now, it would be a very poor argument to bring before a body of mechanics, to say that a man who wanted to engage in the art of harness-making, or as a machinist, should be sent out as well qualified on two years' apprenticeship, when three years is considered only sufficient to obtain the rudiments. The time has fully come when we should insist upon at least a high-school education, as preparatory to entering upon a course for a professional life where health and life are to be committed to its keeping. Has not experience taught us that with the best possible dental and medical school curriculum, faithfully observed, but a small per cent. succeed in becoming skillful members of the profession in medicine or dentistry? With these indisputable facts before us, I cannot see any demand for recruits that cannot attain to a high standing. Much criticism of the dental and medical colleges, also of the dental departments of universities, for graduating poorly-qualified men, has been indulged in; but I apprehend that the mistake is made by the would-be preceptor, in encouraging young men in the study of dentistry and medicine that have no aptitude for a professional life.

Dr. LITCH: I merely wish to occupy the time for one moment, and that is in reply to Dr. Brophy. He asked me the definition of dentistry. I gave a definition which I think a perfectly good one, namely, that dentistry is the art and science of treating pathological conditions of the teeth. He claims that by this definition I admit the correctness of his position, that the making and insertion of artificial teeth is not a legitimate branch of dentistry. I will not now discuss the point whether the absence of teeth constitutes a pathological condition of those organs or not, or whether the insertion of an artificial denture can be properly deemed a means or method of treatment. I believe that it should be so deemed, and that, all quibbles apart, the artificial denture has its place in the limits of the definition I have given. But there is quite a large class of cases in which the wearing of an artificial denture is one of the best and often the only means of treating pathological conditions of the teeth, *in situ*. Such, for example, are cases of abrasion owing to excessive use arising from the loss of contiguous teeth. The so-called operative method of

treatment would, I suppose, be to undercut and cap the crowns with gold. The so-called mechanical method would be the making and insertion of an artificial denture to supply the place of the missing organs, and thus relieve the abraded teeth from the abnormal wear to which they had been subjected. Either is a method of treating a pathological condition, though why one should be called operative and the other mechanical I leave to others to explain.

Dr. ATKINSON: I have a few words to say. It is quite time enough for us to show our preferences when we have any one *standard profession* that is accepted and respected. And when we shall have had a university that is independent of the money paid to the professors or teachers, we will then have started the first foundation for true teaching in dentistry or medicine, or any other department of science. But great mistakes in legislation have loosed the very foundation of conferring degrees, by allowing incompetents to charter other incompetents to teach. We have been lying from the first to the last. There never was an M.D. or D.D.S. honestly conferred on earth. If you would give certificates of advancement, that would be something. The idea of the money being used to induce those that are commissioners to confer a degree they would not get if the degree was not conferred! That has done most of the mischief. The next mischief is nepotism. There is where it lies. If you allow any man who thinks he knows anything and a person who does not know anything about it to converse about the science they are examining him in, you need not be afraid of graduating ninnies or incompetents. I tell you I do not know a single faculty—if not acquainted, and they were allowed to examine each other—that would not each ignore the other. I know what I am talking about. Suppose we could take them as they stood, to know nothing about them, and by that examination I guarantee not one of them would get a degree.

Dr. ABBOTT: I would impose, in addition to a severe examination at the end of pupilage, a preliminary examination, to be a test of the fitness of the applicant to become a student. I have just received a letter from a young man with reference to entering a dental college, and in my answer I shall suggest that he go to school awhile first. I should examine, if I had only ten men in the class. It is high time this Association took some decided stand in this matter. The colleges may require enough in the way of tests from the students when they go out, but their rules are not stringent enough with regard to the general education of students. I would require a written preliminary examination, and this is the only time when

it can be told whether students have the necessary qualifications. If some such requirement were insisted on, it would be a great step in advance.

Dr. BUCKINGHAM: There have been assertions made that we want to correct. One was, that dental faculties graduate students for the sake of getting their money. This is not so. In the first place, they have no inducement to do so. They do not lose anything by rejecting them, as the student pays his money when he enters, and it is not returned if he fails to pass the examination. I do not think there is a college that would make an agreement either to pass a student or return his money.

I believe the colleges are doing the best they can under the circumstances, and if you would give them your support they would do better. Colleges, like all other institutions, must have material support, or they will settle into a routine, and not advance. If more of the dentists would visit the colleges when they are in session, and learn more about their working, there would be less said against them at these meetings. I do not claim that the colleges are perfect, but do claim that they make better practitioners of dentistry than are made in private offices. Their curricula of study and their facilities for teaching are better than can be adopted by any private instructor. When a student enters college, he has the facilities to study anatomy, physiology, and pathology better than he can ever have anywhere else. He also has a systematic course in chemistry, operative and mechanical instruction, and when he graduates we certify that he is competent to practice dentistry. We do not say he is perfect, and has nothing more to learn. If the best student of any college were to close his books when he graduated, and stop studying, he would not be much of a scholar in a short time. Knowledge is only acquired and advanced by constant study. All that can be done in the college is to teach the student the principles of the profession, and let him put them in practice after he has graduated. We think dental colleges should teach all that is required in the ordinary practice of dentistry, and we are therefore in favor of having colleges of our own, and not medical colleges with dental departments. We know very well that the practice of medicine and the practice of dentistry overlap each other, but the general practice is very far apart. The physician depends upon his medicine stimulating and assisting nature to perform a cure, while the dentist expects his work to prevent further progress of the disease. As the prevention is different from the cure, so we think the teaching should differ. A student should

first learn that which is essential to his practice; then, if he has time and capacity, he can add to it. He should not lay in a large stock of information which he cannot use, and neglect more important material.

The science of medicine has been so extended that no one person can grasp it all, and if dentistry is added to it one or the other must suffer from the error. Let us compare the surgeon and medical doctor with the dentist, and see the difference in their requirements. They both should have a knowledge of anatomy; the one a minute knowledge of the whole system, and, if he is a well-informed doctor, he will have a general knowledge of the teeth and their diseases; while the dentist must know the teeth and the parts surrounding them, and only have a general knowledge of the remaining parts. As in the department of anatomy, so also in all the other branches of the medical science. Now, there is a very wide difference between a general or superficial knowledge of a part and that minute knowledge which will enable a practitioner to treat it properly. Again, a physician requires a full comprehension of all the medicines; the dentist only a very few, his treatments being nearly all mechanical. We might carry this comparison to an unlimited extent, but we have probably said enough. It was only intended to show that while they run partly in the same track, the requirements and practice are very different.

But dental departments in medical colleges do not require the student to take the whole course of medicine. The dental department of Harvard College is separate from the medical. The dental student attends some of the lectures with the medical students, but not all. His dental instruction is given separately. The same applies to the University of Pennsylvania. The dental student there attends but the first course of medical lectures, and as the course is a graduated one of three years, in which the instruction of each course is different, and as the dental student receives only the first course, he receives instruction from four medical professors, while the medical student receives his instructions from eleven. We speak of these two colleges because we know more about them than of the other medical colleges that have dental departments, but we believe that what has been said will apply to all. Now, is it not better to have in dental colleges teachers who are well acquainted with medical science, and have them select from the medical books the subjects that apply to dentistry, and condense and place them in proper form? In this way the whole science of medicine can be gone over without cramming the

student with matter which may be of great value to the medical practitioner, but is of little use to the dentist. Or, why do not those who claim dentistry to be a specialty of medicine require the student to take the whole course in medicine, as other specialists do? As it is now taught in medical schools, the dental student receives his instruction from three or four medical teachers, and the other seven or eight are not required. I want it distinctly understood that I do not object to dentists graduating in medicine, but do claim that a dentist may practice dentistry scientifically without such a degree.

VOLUNTEER PAPERS,

BELONGING TO NO SECTION.

VOLUNTEER ESSAY BY JOSEPH RODES BUCHANAN, OF NEW YORK.

On the Centric Relations of the Teeth, the Mouth, and the adjacent parts to the entire Constitution, through the medium of the Proximate Portions of the Brain.

IN this paper I propose to state certain physiological principles which were discovered nearly forty years ago. My chief discovery in 1841 was this, that in many persons the functions of the brain were so delicately sensitive that when the individual is passive there is an instantaneous sympathy between the exterior and interior of the cranium, so that the sensations in the scalp and membranes indicate exactly the condition of the subjacent portions of the brain, and every application to the exterior of the cranium may affect the brain, whether it be heat or cold, medical agents, galvanism, or the human nervaura, commonly called animal magnetism.

That a sufficient amount of this animal magnetism may produce in certain persons a state of somnambulism and trance, with insensibility to surgical operations, is an old and familiar story, as many teeth have been extracted and surgical operations performed in this state of insensibility in private practice and in hospital operations.

My discovery in 1841 was that the nervaura of the hands may be applied so as in sensitive persons to concentrate the energy of the brain in any part, and thus produce a manifestation of its functions, either mental or physiological,—such as love or hate, benevolence or combativeness, muscular strength, respiration, digestion, calorification, or refrigeration,—controlling the pulse, the muscles, the bowels, the lungs, and the physical sensibility, as well as the emotions and passions. At the same time I discovered the science of psychometry, by means of which much more minute investigations of the brain may be made.

These experiments on the brain, since my first announcement of the discovery, have been repeated throughout the greater part of the civilized world in a more or less scientific manner, and some of my discoveries of functions have been verified by Prof. Ferrier's experiments on animals.

In the prosecution of these experiments I have organized what the world never before had, a science of ANTHROPOLOGY, and this has opened up to science what was before a complete *terra incognita*, the anterior inferior region of the brain—the region lying behind the face, with which the dental profession is in continual relation.

Gall and Spurzheim, to whom we are indebted for the true anatomy of the brain, are the only scientists who have ever undertaken systematically to develop the functions of the cerebral convolutions. Their discoveries, though crude, were substantially correct, and have in the main been verified or corrected by my experiments. But they located organs only as they were accessible through the exterior surface of the cranium, and did not attempt to explore that basilar region which is covered by the neck and the face. Neither did they realize that the brain was the controlling center of physiological as well as mental life, and that *all physiological functions had controlling centers in the brain*. Hence their system was psychic or phrenological, and not physiological. The development of the character of the brain as a physiological organ was reserved for my peculiar experiments. And as the most important physiological functions of the brain lie in that region overlooked by Gall, which is covered by the face and neck, and as these functions are powerfully affected by the adjacent parts of the neck, face, and mouth, it is clear that a proper understanding of these functions and localities and the mode in which they are affected by diseases and operations must be of great importance, not only in dentistry but in the general practice of medicine; for every morbid condition, anywhere from the top of the forehead to the base of the neck, must affect powerfully the cerebral structures behind it, constituting the antero-basilar aspect of the brain.

There are two modes of studying this subject. First, the method I have adopted of developing by experiment all the functions of this antero-basilar region, and drawing therefrom the inevitable inferences as to how the adjacent structures may affect the brain, and how the brain may, in turn, affect the adjacent structures,—thus developing a new symptomatology of the mouth, teeth, face, and neck. As, for example, when the incisor teeth and gums in their irritations produce

a cough, or when pneumonia, reacting from the controlling organs in the brain, produces a peculiar red line on the gums.

To present this matter in a clear and practical way I should proceed, omitting all history of experiments and discoveries, to state the locations of the functions in the antero-basilar region, and the manner in which they may be affected by diseases and operations.

What is called the forehead, usually uncovered by hair, contains the organs of the purely intellectual powers. Hence, this is the region in which we feel a sense of tension, or aching, or heat, from overaction of the intellect in observation or study. This part, the front lobe of the brain, sympathizes with the bronchial region of the chest, and hence a tensive pain in the forehead is one of the symptoms of bronchitis. The front lobe has no physiological energy, but tends to expend the vital force. Hence, protracted mental labor is exhausting, and the continued working of the intellectual faculties would be fatal to life if not arrested by sleep.

The base of the front lobe—the convolutions resting on the supra-orbital plate and covering the entire socket of the eye—contains the organs of perception, which use the eye; in other words, the organs of vision. Hence the intimate sympathy between the eye and the brow or base of the forehead. The destruction of one eye causes an ultimate shrinkage of the perceptive convolutions of the opposite side, as in the case of Curry, of Alabama. Behind these perceptive or visual convolutions, running back along the base of the middle lobe, we come to the region of sensation or sensibility. This I discovered by external observation as far back as 1837–8, and in 1841 proved by experiments on the brain in the living. Recently Prof. Ferrier has completed the demonstration of this discovery by a cruel experiment on a monkey. By destroying with an iron rod this base of the middle lobe on the left side, he destroyed sensibility in the right half of the body; thus confirming what I had known and taught for a third of a century.

The anterior part of the region of sensibility near the visual organs contains the organ of hearing, which is tributary to music and language. Prof. Ferrier neglected to notice whether hearing was affected in his experiment on the monkey. As the region of sensibility lies along the zygomatic arch and malar bone, it follows that breadth of the head in this region indicates a sensitive temperament, easily affected by medicine or by pain, sensitive to magnetic influences, easily impressed by animal magnetism. When the head is hot in the temples there is great sensitiveness; the eyes are intolerant of

a strong light, the ear of loud sound, and the surface of pain or of any rude contact. If the heat is on one side the sensibility is developed on the opposite side, and limited by the median line. Those with this region large are intolerant of everything that gives pain, and unless they have large firmness cannot bear it. At the same time, they are sensitive to magnetism, and their pains may be relieved by dispersive manipulation with the hand. The existence of this heat in the temples produces a sensitive, excitable condition, which should forbid dental operations until it is relieved. This may sometimes be done by sponging off the temples with warm or hot water, or by rapid dispersive passes with the hands, chiefly in a backward direction.

We come next to the organs behind the face. These organs are reached and excited through the face, and in making a map of external development they are necessarily marked upon the face. The space which they occupy at the base of the brain is much less than the space marked externally on the face.

The functions controlling the alimentary canal commence at the base of the zygoma and articulation of the lower jaw, which locality controls the stomach by giving the sense of hunger, and is phrenologically expressed as the organ of alimentiveness (which was located too high on the old charts of phrenology). Gastric digestion does not depend *exclusively* on this organ, for it is reinforced by the portions of brain behind it. From that spot, extending under the middle lobe, along the petrous portion of the temporal bone, the functions control the entire intestinal tract, from stomach to rectum inclusive. Externally this is marked along the jaw to a point below and behind the angles of the mouth, corresponding with the lower anterior molar teeth.

This location of the alimentive functions in the brain may easily be verified if we observe that great breadth and fullness in this region just in front of the ears, with a florid appearance of the surface, is accompanied by active appetites. In the drunkard and glutton there is frequently a red and bloated fullness at this spot. Great narrowness across and hollowness just in front of the ears, with a pallid, shrivelled appearance, is connected with deficiency in the appetites and digestive powers.

These locations indicate that the digestive organs are brought through the brain into intimate sympathy with the molar teeth of the upper and lower jaws, and with the lateral posterior portion of the tongue. I would therefore invite you to observe the influence

of diseases of the molar teeth and of operations on these teeth upon the digestive organs, and also the influence of the digestive organs on the molars, for I desire to profit by your experience. Do you not find toothache responsive to gastric conditions, and do you not find molar disease exercising great power over the stomach and bowels, and do not all the teeth when much irritated affect the alimentary canal?

Dr. Condie, in speaking of cholera infantum, says that the process of dentition is unquestionably a predisposing cause of the disease, and therefore considers it necessary in this disease to examine the gums, and lance them if hot and swollen.

Dr. J. F. Duncan, attending a Dublin work-house in which there were sixty or eighty children under two years of age, described in the Dublin *Medical Journal* a severe ulceration of the mouth and gums of children very much like a mercurial ulceration, accompanied by diarrhœa, high fever, and enteritis, progressing rapidly to a fatal termination, which was controlled by such remedies as counter-irritation, acidulated decoction of bark, wine, columbo, and nitric acid. The remarkable fact in this case is the intimate and complete sympathy between the condition of the mouth and the abdominal disease. He could do no good at all by local treatment of the mouth, but counter-irritation of the abdomen worked like magic. A mustard plaster on the abdomen followed by a blister for an hour controlled the diarrhœa, controlled the fever, *and controlled the disease in the mouth.* Which proves that, while the mouth may set up disease in the abdomen, disease in the abdomen may be the sole cause of disease in the mouth. Hence, if a dentist is to take care of the teeth, he should understand enough of medical philosophy to discover a morbific cause in the abdomen when it exists, and treat the causes instead of the effects.

The last molar or wisdom-tooth, especially that of the lower jaw, occupies a position which gives it a remarkable power over the nervous system, beyond that of all the other teeth.

All the teeth, especially of the lower jaw, share in this power over the nervous system, but it attains its maximum in the wisdom-tooth. The cause of this is that it approximates that region of the brain in which the insane tendency resides. The insane diathesis or tendency is the result of an extreme degree of excitability in the mental faculties and organs, which renders them unable to maintain their equilibrium under disturbing influences. This excitability depends upon the most sensitive region of the brain, which

attains its maximum at the entrance of the carotid artery. It is not far from the region of physical sensibility.

Externally we find the carotid artery and jugular vein, and along the carotid artery the superior cervical ganglion and carotid plexus, which with their prolongations control the circulation of the anterior part of the brain, and may either cause a hyperæmia in any of the intellectual organs, or by a spasmodic action may shut off their circulation and paralyze their functions. Mania in the anterior part of the brain depends on the circulation from the carotid artery, as in the posterior part it depends on the vertebral artery.

This external arrangement corresponds with the location of the internal function which I have demonstrated in the brain, which in its normal action gives cerebral excitability, and in its abnormal excess produces a liability to insanity, as the region of the brain a little farther back produces in its excess a tendency to rage and to murder, which are half-crazy impulses.

From the location of the wisdom-teeth they are thus enabled to exert a greater power over the cerebral circulation and excitability, —a depressing and deranging influence,—which may be manifested in a thousand different ways, especially in melancholy gloom, disqualifying for study and for the enjoyment of life, unfitting for business, and producing mental confusion and hallucination, ill-temper, restlessness, and unpleasant dreams, and in extreme cases mania and even paralysis. One of the most eminent dentists of this country, a member of your body, interested me by the description of a species of hallucination or optic illusion which he experienced during the cutting of a wisdom-tooth. Dr. Samuel Sexton, who has given much attention to these subjects, reports that in some cases progressive dementia has been arrested by the repair of a tooth, which was the real cause of the trouble, though apparently making no disturbance itself.

Of course, I do not say that this influence on the brain and nervous system is strictly confined to the wisdom-teeth, although more perfectly developed in them. The molar teeth all participate in this influence, and a similar influence is exerted by the parts of the neck and throat lying between them.

Dr. Fleiss, in a German medical journal ("*Journal für Kinderkrankheiten*"), refers to these paralytic attacks from dental causes, which he says had frequently been erroneously ascribed to rheumatism or to contusions. They arise, he says, in the *second dentition*—scarcely ever in the first, which is more inclined to convulsions—the second dentition being more inclined to paralysis and neuralgia. In the

cases of paralysis recorded by authors, Dr. Fleiss finds that the *molars* have generally been mentioned as being in progress of escape from the gums. The attacks come on rather suddenly, preceded by some heat in the head and feverishness. Usually an arm is affected; sometimes an arm and a leg, or even both legs; sometimes both arms. It may last a few weeks or months, or may become incurable and produce an atrophied arm. The paralyzed limbs are disposed to be convulsed under mental irritation. (I would remark that this statement of Dr. Fleiss shows that the brain is in a somewhat exsanguine condition, which is the natural consequence of irritation at the base of the middle lobe.)

Sometimes the paralysis is obstinate, and symptoms of cerebral and spinal affection, dyspnœa, palpitation, coma, and death occur. In a case of paralysis of the left arm, in a boy of five years, "the anterior milk molars were found lying half decayed in the gums," and near and between them were the edges of the permanent molars in a row in the gums. Being accidentally killed, it was found that the spinal cord on the left side at the roots of the brachial nerves was congested, and that a turgescence of the veins extended along the shoulder and neck to the face on the left side, being especially marked in the submaxillary region.

In this case I would say that the transmission of the paralysis was by direct nervous and vascular connection, favored by the paralytic tendency of the brain. But when the deranging effects are produced by the centric influence on the brain, they are more general and are more apt to be developed in the brain itself, and in the lower rather than the upper part of the body, since the basilar region of the brain has a more intimate relation to the lower part of the body.

The paralysis from superficial connections, instead of centric influence, illustrated by Dr. Fleiss, may also be illustrated by the numerous examples of diseases of the eye and ear caused by defective teeth transmitting their irritations through the tri-facial and facial nerves. Even myopia has been sometimes attributed to this cause. But this is foreign to my subject—the *centric relations* of the mouth. The relation of the anterior teeth to the thoracic region was very forcibly shown by Prof. Bolling, of Nashville, formerly of Alabama; and the same truth was abundantly illustrated by a German physician, Dr. Fredericq. I regard their essays as the most valuable statements that have ever been published to illustrate the philosophy of pneumonia by its dental symptoms. They simply stated the facts, without knowing anything of the

bearing of these facts on cerebral physiology. They had no idea of my teaching for many years that the respiratory functions were so located in the brain, just above the medulla oblongata, as to correspond to the lower anterior part of the face, and to maintain as close a sympathy with it as the forehead does with the anterior part of the front lobe.

Dr. Bolling says: "I have frequently observed in pneumonia a symptom of which I do not remember to have seen mention made by any other, and which I have never noticed in any other disease. It consists in a deposition on the teeth just along the margin of the gums of a matter of different shades of color, from a light orange to a dull vermilion, forming a line about a sixteenth of an inch wide, and of a deeper tint at the gums, and paler as it recedes. Unlike the blue line said to be found on the margins of the gums in lead-poisoning, and the line on the same part of a deeper shade than the rest of the gum noticed by Dr. Theophilus Thompson in phthisis, and mentioned in the London *Lancet* for September, 1857, the appearance in question is noted on the teeth, from which, indeed, with care, it may be principally removed by wiping; though, occasionally, a somewhat durable stain remains upon the enamel. In regard to the manner of its production, I am at a loss for an explanation, though it is probably an exudation from the margin of the gums. At first I thought it might be produced by the deposition of the coloring matter of the expectorations; but I have seen it in cases in which bloody matter was not expectorated—indeed, in a few cases of latent pneumonia, where there was neither cough nor expectoration; and in one instance I was led to suspect the presence of this form of the disease (which I ascertained with certainty by auscultation) by this symptom alone.

"Perhaps the miasmatic poisoning of the system may in some way lead to its development in pneumonia; for it is likely that if it were of as frequent occurrence in other localities as this, it would have been noticed before. Still I do not remember to have seen it in any of the forms of uncomplicated miasmatic fever. I have made no note of the proportion of cases in which I have observed it, but I think at least in one-third or one-fourth. The cases in which it is present are generally severe, it being very rarely found in mild cases."

If severe pneumonia produces the appearances described by Dr. Bolling, it would seem probable that other pulmonary diseases would also show themselves by the teeth and gums. In the seventh

volume of the French *Medico-Chirurgical Review* is contained this statement of Dr. Fredericq's observations:

"M. Fredericq published some observations in 1847, in which he stated that *in phthisis a red streak* is constantly to be found on the gums opposite the lower incisors, and sometimes the upper ones also. Since this he has paid great attention to the subject, and now says that in the latter period of all chronic diseases, some time before death, a blue or red streak will always be found; but that in phthisis it is one of the earliest signs. In all the cases of phthisis, without exception, that have come under his notice, he has met with this brick-red or blue streak. The *brick-red* color is especially found in inflammatory phthisis, or at least when much bronchial irritation and nocturnal fever are present; while the *blue* color denotes a less active form of disease, and is oftenest found on those who suffer from abundant pneumorrhagia, although by no means always indicating the probability of the occurrence of this. In a few cases, a *white* line, as observed by M. Vanoye, contrasts with the general color of the mucous membrane, and those who exhibit it are usually of a marked scrofulous and cachectic habit.

"These streaks are of great importance in announcing early phthisis in those cases in which doubt prevails as to whether bronchitis or catarrh is connected with tubercle. The author has never known persons suffering from bronchitis in whom this mark was absent afterward become the subject of phthisis; while those in whom it was distinctly present have all afterward furnished signs of tubercle. The deeper the color the more rapidly does the disease proceed, while it is a good sign to find it becoming paler.

"Patients in whom the process of softening has become temporarily arrested, and who believe themselves cured, continue to offer the blue mark, but paler than before; but when the disease recommences its march the mark becomes plainer.

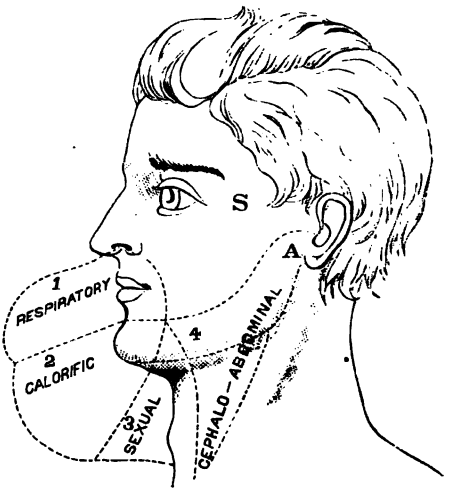
"In chronic abdominal affections there is a dirty, livid-looking streak along the whole extent of the gums, and much broader than in phthisis.

"The following are the author's conclusions: 1. The red, blue, or white streak along the incisor gums is only of real semeiological importance when manifested early, since it is always seen in the latter period of chronic disease. 2. It is observable as soon as the cough occurs in phthisis. 3. In aged persons, where there is retraction of the gums, it is not present. 4. Where the brick-red streak exists it is a sure indication of tubercle; the blue one, which

is common in other diseases, is also frequently so. 5. Chronic abdominal affections give rise to a livid streak along the entire gums."

Influenza being a lighter affection, located higher, would, according to these principles, manifest its physiognomic sign higher or more anteriorly. Accordingly, we find that in an epidemic of influenza at Sacramento City, described by Dr. G. G. Tyrrell, "herpes labialis was a constant symptom."

The dentition of every infant is an illustration of these principles. As the dentition begins in the incisors and extends on each side, a high degree of irritability is developed by sympathy through the brain in the lungs—a sympathy proved by the observations of Bolling and Fredericq—which renders them liable to every disturbance, and sometimes develops into bronchitis, or at least into a cough. This irritability, also, sometimes develops *laryngismus stridulus.* A feverish or heated condition, and a consequent tendency to eruptions of the skin, is a regular attendant, and arises from the impression of the anterior dental region on the medulla oblongata, the great source of bodily heat and cutaneous conditions.



As a guide to observations on this subject, I would suggest the division of the lower facial region into four sections. 1. The respiratory, extending from the ala of the nose to the roots of the lower incisors. 2. The calorific region, embracing the chin. 3. The sexual region, extending from the molar and bicuspid junction down the neck. 4. The abdominal and cerebral region, lying near the posterior angle of the jaw. I do not present this as a complete and accurate statement, but merely as a help to observations.

The sexual region in its upper part is an external development in the direction of the parotid gland, which has so intimate a sexual relation that its inflammations are very liable to sudden metastasis, either to the testes or to the mammæ. The influence of the parotid

gland in parotitis or mumps is also analogous to that of the molar region; it produces headache, loss of appetite, and sometimes great heaviness. The influence of this region on the brain is enfeebling and deranging, but not so exciting as the more anterior regions, nor so oppressive and injurious as the posterior region. I think the further progress of pathology will in time establish that the sexual functions are connected not only with the superior central region of the cerebellum, which I consider established by pathology, but with its anterior inferior region and the cervical region of the spinal cord—a suggestion which I believe is entirely novel, and which I publish now by way of a *caveat.*

The influences of the third and fourth regions on the brain are combined in the larynx and throat. The comatose and paralytic tendency of diseases located there is very well known, and if this paper had not been prepared in great haste, for want of time, I might have arranged a very striking and illustrative group of pathological symptoms belonging to these regions, showing that they have an influence on the brain which comes from no other locality, because no other locality is in so close connection with the central basilar region of the brain. The functions of this central basilar region I have known by experiment and taught for a third of a century, but they are not known to physiologists, because they have not known the best methods of investigation. Whenever they come to the border line of the material and the psychic, they are utterly lost. Like the hen that has raised a brood of young ducks and sees them swimming out on a lake, deeply alarmed and disgusted in the belief that they are going to perdition, so does old physic look on young physic exploring new realms in science.

We see the influence of this central basilar locality on the brain in scarlatina, croup, diphtheria, cynanche tonsillaris, laryngitis, tracheitis, and bronchocele.

"In laryngitis," says Dr. Bell, "where the inflammation is intense, the innervation may be so profoundly disturbed as to mask the evidences of the local disease." That is to say, the effect on the brain is greater than the local effect of the inflammation. The patient is drowsy, disinclined to speak, but if questioned says that he feels no local pain.

In acute œdematous laryngitis, running to a fatal end in from one to five days, the patient becomes enfeebled, delirious, drowsy, and at last comatose.

In the membranous laryngitis or croup, which extends into the

trachea, and even affects the bronchial region, the downward extension justifies us in inferring, according to cerebral physiology as I have discovered and taught it, a more excitable and wakeful, restless condition than when the disease is confined to the glottis.

"It is often indicated," says Prof. Bell, "by variable spirits, greater readiness than usual to laugh or cry. The patient exhibits great anxiety and restlessness, and a frequent desire to change from place to place." This condition is one of wakefulness, while a higher location produces the drowsy or comatose tendency, all of which is explained by a true cerebral physiology. Under this downward extension of the disease, according to Bell, the patient "tosses about in great distress," grasping the objects around him convulsively, and exhibits great exhaustion of the vital energies, terminating in lethargy and death.

All severe diseases of this neck region exhaust the physiological power of the brain and exhibit a comatose tendency, showing that they kill by nervous prostration.

Dr. Cotting, of Roxbury, reported an interesting case of a female in which a membrane was developed, extending down the trachea into the bronchial ramifications. The result is easily deducible from the principles of true cerebral physiology. The bronchial region in the body, according to the science of sarcognomy, corresponds with and maintains the closest sympathy with the front lobe or intellectual region. Hence excitement in that region gives great mental activity and consequent wakefulness; it also produces great exhaustion of vital force, as we see results from the front lobe in prolonged study or wakefulness, which prevents the intellect from resting. This tracheal and bronchial condition therefore necessarily produced sleeplessness and exhaustion. She continued sleepless and restless, constantly changing position, for about six days and five nights, and then ejected the lining membrane by great effort, and rested or slept for about half an hour, and being now relieved should, according to medical ideas, have speedily recovered; but, in fact, in a few hours she quietly ceased to breathe from mere exhaustion.

There is no medical explanation for the rapid death caused by inflammations of the larynx and trachea; life is rapidly exhausted by a disease which exhausts the base of the brain, and the sufferer is conscious that his life is passing away. George Washington lost his life from this disease in twenty-four hours, and from the first he felt that it would be fatal. Ten times the amount of disease at the superior anterior region of the brain would produce no danger,

for it is not a vital situation; and fifty times the amount of disease in the lower limbs could be safely borne.

The trachea is not simply a mechanical channel for the air; it is a sensitive tract in the most intimate sympathy with the medulla oblongata and cervical portion of the cord. Hence it is one of the nearest approaches to the citadel of life; and sudden death has sometimes occurred during tracheotomy or from fracture of the larynx, which medical science does not explain. The sudden occlusion of the trachea by a ligature is as fatal as a division of the spinal cord in the neck; indeed, more so, for it instantly arrests respiration and circulation also. So it seems that life depends directly on the trachea, through its relations to the medulla.

I have stated that the region of the lower jaw and neck, *by its relation to the brain*, affects the lumbar, pelvic, and crural regions, although it may sometimes, by direct nervous connection with the brachial region of the cord, affect the arms. This is well illustrated in *laryngismus stridulus*, or spasmodic croup, in which the hands are generally clenched, the feet turned inward and downward, the backs of the hands and feet often swelled. "In a few cases the buttocks or groins become tender and exude watery lymph; and in perhaps every case of the disease, the buttocks, even when well covered, are as cool as if newly washed." Frequently the child is unable to stand or walk erect, and convulsions are a frequent accompaniment. This effect on the buttocks is also noticed in ordinary dentition. Blotches or papular erythema often appear on the buttocks, thighs, hips, and the lower jaw, which correspond to their controlling region in the brain.

No physiologist has ever reached or pretended to reach the causes of these peculiar associations of symptoms, which a true cerebral physiology explains with ease; and I may say that a large mass of the mental and physical symptomatology of disease, and groups of sympathetic symptoms, presents but a tangled wilderness, in which science has opened no road; and whatever we know has only been learned empirically and retained by memory without the help of reason.

Chronic laryngitis may arise from irritations of the mouth or caries of the teeth, and a celebrated Italian singer lost her voice in that way. But I have no time to adduce illustrations.

All irritations of the teeth and gums affect the antero-basilar regions of the brain, which tend to lower the moral energy and disqualify the individual for society, producing excitability, temper,

resentment, peevishness, and a depressed state of health and spirits. It is impossible to maintain high health with any irritations or morbid influences in the mouth; hence a clean, healthy mouth is one of the most indispensable conditions of health. Diseased teeth or unwholesome dental applications in the mouth have so prostrating an effect that sometimes life is hardly worth living until they are removed; and when they are removed there is a rapid and almost magical improvement in health. It is a great mistake to suppose that noxious substances in the mouth are harmless if they are not soluble enough to be absorbed. My experiments have been showing for forty years that every substance in contact with the human body produces its own specific influence from the external surface just as it would from the internal surfaces. A sensitive individual can hold different metals in the hands, or different medicines contained in envelopes, and incapable of absorption, and distinguish them and state their influences as well as if they had been swallowed. All who have attended my college lectures are familiar with this fact; hence, when anything is inserted in the mouth, it should be a substance which is in itself wholesome, and not poisonous or depressing. Of late years Dr. Charcot, of Paris, has been making some experiments on this subject, and his metallo-therapy is a reproduction of what I discovered in 1841. (The Kentucky State Medical Society appointed a committee to investigate my experiments in 1877, but they were so indolent or preoccupied that no action occurred during the subsequent months that I remained in the State.) While these general remarks are applicable to all the teeth, there is a marked difference between the anterior and posterior teeth. The molar teeth have a greater influence on the abdominal organs and brain, while the incisors, canines, and bicuspids exert their influence chiefly on the respiratory and calorific functions. In other words, dental irritation has a greater effect on the bowels as it advances further back in the jaw from the front. The incisors and canines have the strongest effect on the respiratory organs, and the lower incisors are the most exciting and most liable to develop a cough. The lower incisors and canines are also more heating and feverish in their tendency, from their more direct influence on the medulla oblongata.

Any extensive observer of nature might verify this close connection of the respiratory and calorific functions with the anterior part of the mouth, which covers the cerebral organs of respiration and calorification. My own experiments demonstrate that these organs

are located in the brain, behind the mouth; and the important experiments of Chossat on animals, which have not been appreciated by physiologists generally, but which I consider the most valuable and satisfactory ever performed in vivisection, clearly traced up the calorific power to the medulla oblongata, and traced its operation from that controlling center through the spinal and ganglionic systems in a manner which fully corroborates my own experiments.

To the development of the medulla oblongata the chin externally corresponds—not, of course, with the precision of necessity, but with sufficient uniformity to become an important external sign. The chin is well developed in races that have calorific power well developed, and the tendency of such races is toward fever. The chin is deficient in the African race, and the negro has little ability to resist cold, and very little tendency to fever; almost entire exemption from yellow fever. The negro suffers in cold climates, the white man in the tropics. The infant has nearly the negro physiognomy, and has less ability to resist cold than the adult.

The respiratory organs are always well developed and strong when the lower part of the face around the mouth is prominent.

As respiration and calorification need protection in cold weather, nature has placed over their organs in man a protective beard, and many persons wear their beards simply because they find them a protection against colds. Some are liable to catch cold from shaving around the mouth, unless they cover it with a handkerchief; and experience shows that a small woollen protection or muffler around the mouth, chin, and back of the neck gives more protection against cold, by protecting the vital organs of the brain, than ten times the amount of clothing on other parts of the body. Of course, dental operations on the front teeth should be conducted in view of these principles, watching the sympathy of the lungs and the anterior teeth.

The teeth of the lower jaw, anterior to the molars, have a decided influence on the pelvic and reproductive organs, and should therefore be critically observed in connection with hysteria, and all derangements, disorders, and excitements of the sexual organs.

This influence, however, extends to the lower incisors also, and it should be remembered that none of these sympathies are rigidly confined to these localities. The affection in the mouth corresponding to or caused by any corporal disease tends to extend through the mouth, and the effect of dental conditions on the body is not confined to their sympathetic locality.

If you would test these principles by observation, I would suggest that you observe and record the dental conditions in all very protracted menstrual derangements, uterine disease, and pregnancy. Drs. A. and M. D. Pinard have already made such observations on pregnant women, and in an essay in the *Bulletin Générale de Thérapeutique* they describe the gingivitis, or affection of the gums in pregnant women. In the examination of seventy-five women they have found forty-five with diseased gums—a condition which they did not find among the non-pregnant. The gums were red, congested, and swollen. "The edge of the free border, especially the interdental membrane, covered a part of each tooth. The slightest pressure on this edge caused a slight hemorrhage. At a more advanced stage the teeth lost their solidity. The mastication, at first injured, became more painful and more difficult as the lesions were more pronounced. The condition was more frequent in the multiparæ than in the primiparæ. It was sometimes in women *of good health and strength*, but generally in those who were much impaired. Treatment by a solution of equal parts of hydrate of chloral and scurvy grass [cochlearia] applied to the gums generally effected cures in about fifteen days."

As I have had little opportunity of making observations on these practical applications of cerebral physiology, I hope that I may learn from your experience what importance to attach to them in the treatment of disease. That the lower jaw holds intimate relations to mania and nervous diseases, and that the anterior portion of it has relations to the sexual as well as to the respiratory organs, gives us an important field of observation.

That the teeth and gums have just such relations as I discovered forty years ago has not entirely escaped the observation of practitioners of medicine; such facts have been developed millions of times under the eyes of physicians, but how few are there who observe and report facts which would be beneficial to science!

I hope to receive from the dental profession many important facts bearing on these physiological principles, and I would call attention to the great importance of the lower jaw in its relation to the brain and nervous system, to the sexual apparatus, to the respiratory and calorific functions, and also to the muscular energies springing from the cerebellum, which are in correlation with the lower part of the face, while the upper jaw holds relations to the anterior part of the middle lobe, which is less important to life, and therefore is less critical in its relations to health than the lower jaw; for this part of the

middle lobe may be injured or even shot away without any dangerous consequences.

That the anterior part of the middle lobe, and consequently the upper jaw, are of less critical importance, was shown very remarkably in two cases—one the case of Phineas P. Gage, who, at Cavendish, Vermont, in September, 1848, was shot through the anterior part of the middle lobe by a tamping-iron, which passed up through the brain, and who had a remarkably rapid and complete recovery. The other case was that of Mrs. Crave, of this city, who (January 26, 1881) was shot in the middle lobe on the left side through the temporal bone, and who even seemed to improve in health and appetite after the wound, but died from an abscess in another part of the body a few days ago. The principle thus illustrated, that the the anterior structures are less important to life, having less physiological power, is in accordance with all surgical experience as to wounds and injuries of the head, the importance or danger of which increases regularly as we pass backward from the base of the front lobe over the top of the head, the maximum danger being at the base of the occiput. The same principle applies on the lower as well as the upper surface, and the cerebral relations of the upper jaw being more anterior than those of the lower jaw accounts for its minor importance. What we thus learn by surgical experience we can learn just as positively and more clearly from the physiology of the brain given in my system of anthropology.

The relation to the sexual apparatus which begins about the junction of the molars and bicuspids extends under the jaw down the neck to the sternum. I regard this as dependent on relations to the spinal cord and cerebellum, which I need not discuss at present. Every one is familiar with the influence of the sexual functions on the development of the larynx and voice at puberty, and the close sympathy that exists through life, but I am not aware that any one has traced this sympathy in the opposite direction to show the influence of diseases in the larynx and trachea over the sexual functions in causing their impairment, to which I would call your attention and ask your observation. That this sympathy extends down to the base of the neck and causes its swelling or development by erotic excitement or puberty has not escaped notice. One of the old Latin poets (I do not recollect his name; perhaps it was Ovid) speaks of the voluptuous maiden whose neck in the morning cannot be embraced by the same collar that was worn the night before. This development of puberty has lately been made a test in recruiting

for the army among the mountaineers of Montenegro. No recruits under eighteen are accepted, and if there is no record of age it is determined by the rule of the string; that is, the length of the face down to the neck is measured with a string, and if the measurement around the neck is larger than this he is accepted as being over eighteen. Animal force you will find associated with the back of the neck (the bull-neck development), and sexual influence with the front.

The sexual locality on the lower jaw, corresponding with the anterior molar, corresponds also with the parotid gland, which is in a line between this locality and the cerebellum; and we know the parotid gland sympathizes with the testes and mammæ. As the throat is a still more posterior location than the trachea, it follows that its influence on the brain is of a still more vital character, as we see in sore throat and diphtheria; and as the mouth in general covers the entire antero-basilar region, its influence is more complete and varied than that of the teeth. Hence we find the entire constitution responding to the mouth. In aphthous stomatitis or thrush we find in association with it not only diseases of the alimentary canal, disordered digestion, gastritis, gastro-enteritis, cholera-infantum, dysentery, and typhus fever, but also diseases of the lungs, especially pulmonary phthisis in its advanced stages. When the aphthous eruption becomes confluent, there are fever, headache, vomiting, and other gastric disorders and derangements of the bowels.

The gangrenous stomatitis or gangrene of the mouth is a very clear illustration of the principles which I have stated. The ulceration in this case begins at the margin of the teeth and gums in front, generally at the incisors, and perhaps most frequently the lower, and extends into the lips and cheeks. Hence it is very feverish, and *its chief complication is pneumonia.* Bolling and Fredericq showed that pneumonia affected the gums and necks of the anterior teeth, and this disease shows that causation may run the other way—that a disease commencing at the anterior gums and roots of teeth may produce pneumonia. At any rate authors, especially the French authors, make pneumonia its chief concomitant; and frequently there is gangrene of the lung to correspond to this gangrene of the mouth.

The intestinal canal is also frequently attacked with acute enterocolitis or with softening, and a diarrhœa regularly comes on at the close.

But the causation may be in the other direction; the stomatitis may be the effect instead of the cause of the other diseases, as Dr. Hall, of Edinburgh, says he found this stomatitis a *consequence* of fever, acute disorders of the digestive organs, inflammation of the lungs,

variola, rubeola, scarlatina, or typhus. It all proves the same thing. The disorders at the mouth strike the vital organs of the brain and produce these diseases, or these diseases arise, and through the basilar organs they affect the mouth.

It occurs between two and ten years of age. It is more severe when it occurs at a later period and in the lower jaw, and the mildest form is when it occurs early *in the upper jaw.*

In *tonsillitis* we have headache, flushed face, feverishness, thirst, nausea, constipation, and high-colored, scalding urine.

Diphtheria, striking further back and down, has also intimate relation to the stomach, yet the appetite is sometimes good. It is nearer to the stomach than the teeth are in a mechanical sense, but according to the centric relation to the brain it is not; its relation is more like that of the posterior molars. It affects the brain with delirium or with paralytic exhaustion. Huxham speaks of his cases dying from a frenzy or disturbance of the brain. It is in almost the same line of centric relation as the anterior teeth to the respiratory and calorific organs, and hence the patients are often carried off by broncho-pneumonia and fever. Its great fatality corresponds to its posterior location. It is nearer the citadel of life, and if the vital force be weak, there is overwhelming prostration; if vitality be strong, there is great reaction and very high fever. It is from the first a dangerous invasion. The nervous system, says Bell, is depressed or stunned, requires no sedatives, and has not strength to bear much stimulus.

For the same reason, gangrene of the pharynx is one of the most fatal diseases. Time forbids me to go further in these illustrations, but I must mention one more, an illustration of the sexual region. Hysteria manifests a decisive symptom in the epiglottis. Dr. Chairon, of Paris, after examining twenty-six thousand cases, speaks of a peculiar insensibility of the epiglottis as the uniform symptom of hysteria. Others, however, say that there is sometimes hyperesthesia instead of insensibility. Syphilis makes its mark uniformly on the throat. Extensive practitioners in throat diseases say that pelvic diseases in women cannot continue long without affecting the throat, and that throat diseases cannot continue long without affecting the pelvic organs.

There are certain principles of common sense and common observation which tend to lead us into this understanding of pathology.

The basis of the brain is the seat of the vital forces. The convoluted structures have psychic functions, and may be very extensively diseased or destroyed without any serious injury to life. When

the corresponding part is removed from the brain of a hen, leaving the basilar structure, it remains a perfect animal but without an idea; all its functions are perfect, but it does not make a voluntary motion because it has neither ideas nor will. It is as if asleep, but it lives and grows and may even be fattened if we put food in its mouth.

The basilar part maintains its connection with the body through the neck, consequently a large neck indicating great basilar development signifies great animal force.

But the basilar region covers the face as well as the neck, and hence facial development indicates basilar development of the anterior parts. The law of physiology is that the anterior parts of the brain are more intelligent, sensitive, and excitable, and have less vital force; the posterior are more vigorous and necessary to life.

We all act on these principles in our judgment of men, without knowing why. In prominent, well-defined features we discover intelligence, but in the lower part of the face we see animal force. If a small face looks out from a window we are sure there is a small body attached, but if a massive face with lower jaw broad and deep appears we are sure there is a very substantial body behind it. We expect to hear a strong voice from it, and if that voice utters a threat we feel that there is danger, for there is bull-dog power to enforce the threat.

The force of animal life diminishes from the base at which life begins in the summit of the spinal chord to its most remote structure in the intellectual apparatus, which, instead of being a benefit or reinforcement to life, is a tax upon vitality to such an extent that if we did not every twenty-four hours arrest its action by sleep it would exhaust and destroy life.

We may therefore illustrate this conception crudely by delineating concentric zones of greater or less vitality from the basic origin of life to its spiritual consummation in the higher intellect, where human wisdom reaches up to the Divine, and would delight to leave the body behind and reach out to the mysteries of the universe, if it were not recalled by the animal nature which demands the bread-and-butter basis of life, and enforces this demand not by the muscles of the lips, but by the masseter muscles of the jaws and molar teeth.

In the mouth, jaws, and teeth, according to the doctrines of this paper, the dental profession stands as sentinel and janitor at the door of the citadel of life, and should, therefore, understand well each passage and winding-way that reaches the interior processes of life according to the definite and exact laws of the nervous system, some of which I have endeavored to delineate.

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